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C. E. L. Linsley.

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ENGLISH
MEN OF SCIENCE

EDITED BY
J. REYNOLDS GREEN, D.Sc.

JOSEPH PRIESTLEY

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J. Paristley

JOSEPH PRIESTLEY

BY

T. E. THORPE, F.R.S.

AUTHOR OF

HUMPHRY DAVY, POET AND PHILOSOPHER

ETC., ETC.



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PREFACE

IN the following account of the life and work of that "hero and type of the intellectual energy of the eighteenth century"—the "honest heretic"—Joseph Priestley, I have, to a considerable extent, made the subject of it tell his own story. After Priestley's death there was found among his papers a short autobiography, dealing with the main events of his life up to the time of his settlement in America. This was subsequently published, with additions and explanatory notes, by his eldest son. Of this biography I have made full use, considering it, of course, as the best authority on the matters to which it refers.

For the account of the Warrington Academy, with which institution Priestley was connected for some years, and which connection profoundly affected his career, I am mainly indebted to Mr Henry A. Bright's paper in the *Transactions of the Historic Society of Lancashire and Cheshire*, 1858-59.

The Yates papers in the possession of the Royal Society have also afforded me much assistance, and have been freely drawn upon.

I am also indebted to the late Mr Henry Carrington Bolton's collection for certain letters and for information concerning the Lunar Society of Birmingham.

For the graphic account of the Birmingham Riots of 1791, when Priestley's house was wrecked, and his library and laboratory destroyed, as described by an eye-witness, Miss Martha Russell, I have to express my obligations to her relative, Dr W. J. Russell, who first made me acquainted with her narrative. I am also indebted to Dr Russell for a copy of the print from which has been prepared the illustration showing the destruction of Priestley's house.

I desire also to acknowledge my indebtedness to Dr Aikin for permission to publish certain of Priestley's letters to his distinguished connection, Mrs Barbauld.

I am further under obligations to Lady Priestley, Lady Roscoe and Mr Sydney Lupton for much useful assistance.

The portrait of Priestley, which forms the frontispiece, has been reproduced in photogravure from the painting by Artaud, now in Dr Williams' Theological Library in Gordon Square. I have to thank the Trustees of the Library for their kindness in allowing the copy to be made.

T. E. T.

LONDON : *May* 1906.

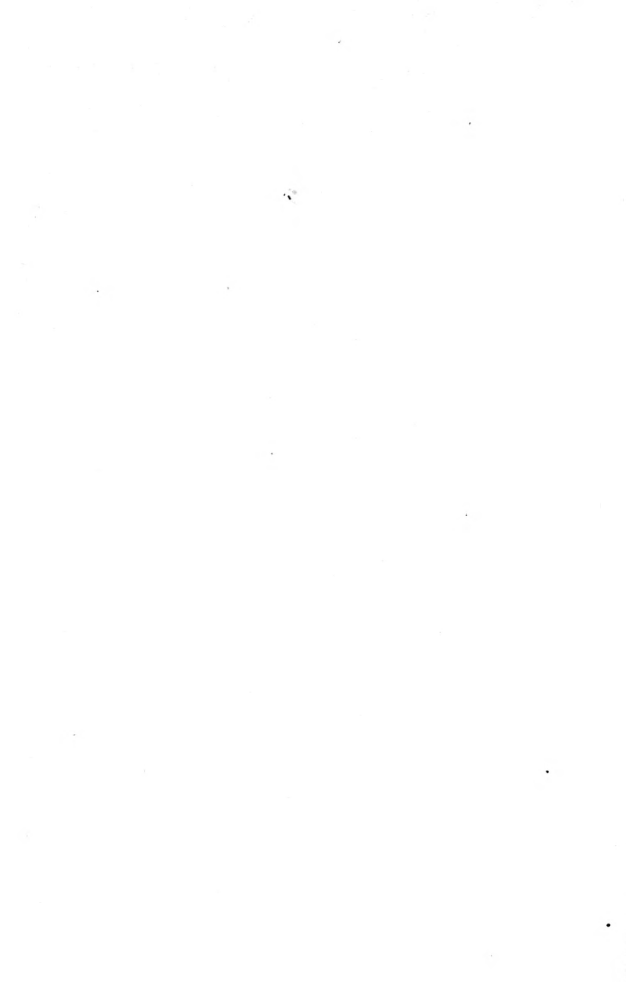
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Joseph Priestley

CHAPTER I

Birth—Parentage—Home Life—Early Education

“IF,” says Mr Frederic Harrison, “we choose one man as a type of the intellectual energy of the eighteenth century we could hardly find a better than Joseph Priestley, though his was not the greatest mind of the century. His versatility, eagerness, activity and humanity; the immense range of his curiosity in all things, physical, moral or social; his place in science, in theology, in philosophy and in politics; his peculiar relation to the Revolution, and the pathetic story of his unmerited sufferings, may make him the hero of the eighteenth century.”

In these few lines Mr Harrison has indicated, in terms sufficiently precise, the leading features in the character and life-history of one of the most remarkable men of the eighteenth century. To what extent he may be regarded as a hero and as a type of the intellectual energy of that century it is the purpose of the following pages to make clear.

Joseph Priestley was born at Fieldhead, in the parish of Birstall, near Leeds, on March 13 (Old Style), 1733.¹

¹ The Gregorian Calendar was not adopted in Great Britain until 1751. In 1752 eleven days were left out of the Calendar, September 3rd being counted the 14th. The change of style probably accounts for the confusion in the various dates of Priestley's birth given by different writers. In Chalmers's *General Biographical Dictionary* the date is given as March 18;

He was named after his paternal grandfather, "an eminent tradesman, as much famed for his heavenly conduct as his grandson (Joseph) has since been for natural abilities."

"The Priestleys," writes Madame Belloc, the great-granddaughter of the subject of this memoir, in her charming essay, "Joseph Priestley in Domestic Life" (*Contemporary Review*, October 1894), "were of an old Presbyterian stock; one branch of the family acquired wealth and lived at Whiteways, but his (Joseph's) own immediate ancestors were farmers and clothiers, people of substance in the yeoman class. We can trace them accurately as far as the middle of the seventeenth century, when one Phœbe Priestley, after wrestling with fever in her household, was herself stricken, and 'lay like a lamb before the Lord' on her deathbed. Her husband wrote a long and touching account of all she said and did, that her children might know what manner of mother they had lost. These people were presumably of the same stock as the Priestleys of Soylands, who ran back into the Middle Ages.

"The children of the Priestley families were all named after scriptural characters. They were Josephs, Timothys and Sarahs from one generation to another. The Bible was stamped into them, and from it they drew all the inspiration of their lives."

Joseph Priestley the elder was born in 1660, and died on August 2, 1745. He married Sarah Healey and had by her eight children, five sons and three daughters, of whom Jonas, the father of Joseph Priestley the younger, born about 1700, was the seventh child and fourth son. Jonas Priestley married Mary, a daughter of Joseph Swift, a farmer and maltster of Shafton, near Wakefield, and had by her six children, four sons and two

in Allen's *American Biographical and Historical Dictionary* and in Thomson's *History of the Royal Society* as March 24; Corry, in his *Life of Priestley*, gives March 24; Hoefer, in his *Histoire de la Chimie*, gives March 30, probably following Dumas's *Philosophie de Chimie*; Cuvier, in his *Eloge*, says that he was born near Bristol in 1728! In a letter to Wedgwood, dated March 23, 1783, Priestley says in a postscript "This day I complete my half century."

daughters, of whom Joseph was the eldest and Timothy the second; Martha, the elder girl, who died in 1812, married John Crouch, and was left a widow in poor circumstances in 1786. Another member of the Priestley family who requires mention for the purpose of this narrative is Sarah, the sister of Jonas and second daughter of Joseph Priestley the elder. She was born in 1692 and married John Keighley—"a man who had distinguished himself for his zeal for religion and for his public spirit." She was left a widow in 1745. Three years before this she took her nephew Joseph, the subject of this memoir, to live with her, and "was fond of him in the extreme." She died in 1764. Her brother John, Joseph Priestley the younger's uncle, died on February 28, 1786, aged ninety-two. "He was a remarkable man and of a singularly happy constitution, both of body and mind."

This happy constitution of body and mind seems indeed to have been a characteristic of many members of the family, the several branches of which were remarkably healthy and long-lived.

Priestley says of his father Jonas that he had uniformly better spirits than any man he ever knew, and by this means was as happy towards the close of life, when reduced to poverty and dependent upon others, as in his best days. These facts are not without interest as serving to account for much that we shall have occasion to note in the character and temperament of the subject of this biography.

Fieldhead, the house in which he first saw the light, had been occupied by the family for several generations. It was a small two-storey building, built of stone and slated with flag, similar in character to many of the

houses still standing in the district, the long, low windows in the upper storeys betokening that they were formerly occupied by weavers. It was last lived in by Martha Priestley (Mrs Crouch), but on the death of her husband in 1786 was abandoned by the family, and, falling into decay, was pulled down about fifty years ago.

The Priestleys were a simple, sober, honest, God-fearing folk, staunch Calvinists, and deeply religious. Jonas Priestley was a manufacturer of "home-spun"—a weaver and cloth dresser—two trades now distinct but then practised in common—who took his week's work on ass-back, on roads little better than bridle-paths, to the Sunday market in Leeds. He was of a class characteristic of the district.

These hand-loom weavers, who lived in the hill country lying to the west of Leeds, were generally men of small capitals; they often annexed a small farm to their business, or possessed a field or two on which to support a horse and cow, and were for the most part blessed with the comforts without the superfluities of life. During five or six days of the week they dwelt in their own little village, among trees and fields, taking no thought of the outside world and contenting themselves with the homely gossip of their farmstead or hamlet. On market day they came into the town in shoals, clad in their quaint corduroy breeches, broad-brimmed hats, and brass-buttoned coats of antique cut, bringing their produce on pack-horses, to await the visits of the merchants—the commercial aristocracy of Leeds, then a town of some 16,000 or 17,000 inhabitants—who were the agents through which the outer world received its supply of Yorkshire woollen

goods. They were a shrewd, careful race, somewhat stolid and slow of speech and not given to great mental briskness or activity, keenly appreciative of the blessings of liberty and usually in sympathy with the political party to whom the cause of liberty was for the moment entrusted; sober, godly souls for the most part; regular in their attendance at public worship, and upon the



BIRTHPLACE OF PRIESTLEY.

whole preferring the plebeian zeal of the Chapel to the aristocratic repose of the Church.¹

And what a world it was in which they thus serenely dwelt apart.

“It was,” writes Madame Belloc, “the time of Louis the Fifteenth in France and of George the Second in England, and the nephews and nieces of Charlotte Princess Palatine were still living, and her letters, whose name is legion, yet lay stored in the cabinets of her correspondents, full of inexpressible details

¹ T. Wemyss Reid, *Memoir of John Deskin Heaton*, p. 7 et seq.

discussed in most expressive language. It was the time when Jeanie Deans walked from Scotland to beg her sister's life of Queen Caroline, and met Madge Wildfire in the way. It was the time when the polite world was composed of 'men, women and Herveys'; when Squire Pendarves was found dead in his bed in Greek Street, Soho, leaving his young widow to be courted by John Wesley and wedded by Dr Delany; when statesmen bribed, and young blades drank, and Sir Harbottle carried off Harriet Byron, whose shrieks brought Sir Charles Grandison to the rescue, sword in hand. It was the period when the Jacobite Rebellion flamed up and expired; when the Young Pretender marched to Derby and the heads of the decapitated lords were exposed on Temple Bar; tragedies, agonies, highway robberies, Dick Turpin, Jack Sheppard, smugglers, the press-gang; Frederick Prince of Wales quarrelling in Leicester Square; Queen Caroline on her death-bed telling her weeping little George, '*que l'un n'empêche pas l'autre*'; Horace Walpole making the grand tour; Dean Swift dying in agonised misery. Merciful Heavens! What an England, of which we possess the daily diary! We can see Hogarth at his easel, and Sir Joshua taking his first stiff portraits, and Garrick going on pilgrimage to Stratford, and the young king courting Hannah Lightfoot and marrying his little bride from Mecklenburg. Without too much verifying of dates it is certain that all this was happening before Dr Priestley was thirty years of age, and that of none of it is there the faintest mention in the account he has drawn up of his own childhood, youth and young manhood, though he was himself destined to be one of the principal illustrations of the Georgian era. For anything which appears to the contrary, he and his friends might have dwelt in some far-distant planet whose inhabitants were wholly given up to study and to prayer."

Priestley says of his father that he had a strong sense of religion, praying with his family morning and evening, and carefully teaching his children and servants the Assembly's Catechism, which was all the system of which he had any knowledge.

"In the latter part of his life he became very fond of Mr

Whitfield's writings and other works of a similar kind, having been brought up in the principles of Calvinism, and adopting them, but without ever giving much attention to matters of speculation, and entertaining no bigoted aversion to those who differed from him on the subject."

We may well imagine that Jonas, with his "strong sense of religion," was one of that earnest band of "several hundreds of plain people" who listened, spell-bound, to the eloquence of John Wesley on that memorable day of May 1742, on which, on Birstall Hill, began the great Yorkshire "Revival."

Of his wife, "a woman of exemplary piety," the mother of the future philosopher, little has been recorded beyond the fragmentary notice in her son's autobiography. He says of her:—

"It is but little that I can recollect of my mother. I remember, however, that she was careful to teach me the Assembly's Catechism, and to give me the best instructions the little time that I was at home. Once in particular, when I was playing with a pin, she asked me where I got it; and on telling her that I found it at my uncle's, who lived very near to my father, and where I had been playing with my cousins, she made me carry it back again; no doubt to impress my mind, as it could not fail to do, with a clear idea of the distinction of property and of the importance of attending to it. She died in the hard winter of 1739,¹ not long after being delivered of my youngest brother; and having dreamed a little before her death that she was in a delightful place, which she particularly described and imagined to be heaven, the last words which she spake, as my aunt informed me, were, 'Let me go to that fine place.'"

During some considerable portion of his mother's

¹ The "Great Frost," as it was called, which, beginning on December 26, 1739, continued with the greatest intensity till February 17, 1740. Above London Bridge the Thames was completely frozen over, and numerous booths were erected on it for selling liquor, etc., to the multitudes who daily flocked there.

short period of married life, Joseph Priestley, together with his brother Timothy, was committed to the care of his grandfather Swift, with whom he remained with little interruption until his mother's death. From this we may infer that the domestic circumstances of his parents were far from easy, or that the accommodation at Fieldhead was unequal to the support of the cloth-dresser's rapidly-increasing family.

Timothy, who, after following his father's business as a cloth-dresser for a time, became an Independent minister, and died in London, has left us reminiscences of his brother's boyhood. He seems to have been particularly impressed with his ability to repeat the Assembly's Catechism "without missing a word," and by being made to kneel down with him while he prayed. "This was not at bed-time, which he never neglected, but in the course of the day."

On the death of his mother, the eldest boy, then barely six years old, was taken home and sent to school in the neighbourhood. Luckily for him, his Aunt Sarah, Mrs Keighley, "a truly pious and excellent woman, who knew no other use of wealth, or of talents of any kind, than to do good, and who never spared herself for this purpose," being childless, offered, in 1742, to relieve her brother Jonas of all care for his eldest son by taking entire charge of him. "From this time," says her nephew, "she was truly a parent to me, till her death in 1764."

John Keighley was a man of considerable property, and at his death, which occurred when Priestley was about twelve years of age, the widow was left with the greater part of his fortune for life, and much of it at her disposal after her death.

By Mrs Keighley's direction he was sent, he tells us,

to several schools in the neighbourhood, especially to a large free school under the care of a clergyman, Mr Hague, under whom, at the age of twelve or thirteen, he first began to make progress in Latin and acquired the elements of Greek. His brother Timothy records that "from eleven to about thirteen he had read most of Mr Bunyan's works and other authors on religion, besides the common Latin authors."

How a well-ordered school was conducted in the middle of the eighteenth century may be gleaned from the following regulations in force in Mr Canton's well-known academy in 1745:—

1. That the School hours are from 7 o'clock in the morning till 12, and from 2 to 5 in the afternoon: except the winter half-year, when they begin at 8 in the morning.

2. That all the Scholars come decently, that is, with their Hands and Faces wash'd, their Hair or Perriwigs Comb'd, and their Shoes black'd.

3. That they bow at Coming in and going out, and when any Thing is given or rec'd; and never wear their Hats in the House or School.

4. That they loiter not, but go immediately to their own seats and move not thence, without Leave, till School is done.

5. That if any Person come into the School whom they know, they are to get up, make a bow, and sit down in their places again.

6. That if the Master be discoursing with, or reading to any Person, they shall not stare Confidently on them or hearken to their Talk, unless required to be present.

7. That they shall not interrupt the Master while a Stranger is talking with him, with any Question, request, or complaint whatsoever, but stay till he is at Leisure.

8. That they shall not presume to talk loud nor make any noise in getting their lessons. A Boy's Tongue should never be heard, but in saying his Lesson, asking or Answering a Question.

9. That there be no buying, selling, changing, laying

Wagers or Gaming in School-time, on the forfeiture of the whole so bought or sold, etc.

10. That those who learn French shall not speak English to any that learn French, on the Forfeiture of ye Bill, or one Hour's Exercise after School Time.

11. That such as learn Latin are also oblig'd not to speak other Language to those that learn it, during School time, on the Penalty last mentioned.

12. That all perform their Lessons and Exercises in fair Writing and true Spelling, and likewise prepare themselves for their Examinations in French, Latin, Accounts and Catechisms every week, both in School times and all Vacations.

13. That such as perform well, shall be prefer'd according to their Merit, and shall have liberty to leave School before the usual Time; but such as are Negligent herein, shall have their Exercises to write over again after School.

14. That none presume to call any Party or Nick-names nor give any ill or reproachful Language, much less Curse, Swear, or Lye, but in all things behave in a quiet, peaceable, and civil manner.

15. That the Boarders shall not go beyond y^e bounds belonging to y^e House on any pretence whatsoever without leave, on the forfeiture of 6d. or two Hours' Exercise after School for Every such Offence.

16. That one Scholar is not to strike another, or challenge him to fight; but in case of any Difference shall acquaint the Master therewith and be satisfied with his Determination.

Whilst acquiring Greek at the public school, Priestley learned Hebrew on holidays of the Dissenting minister of the place, Mr Kirkby, under whose care he eventually came.

The weakly, consumptive habit into which he now fell necessitated his withdrawal from school. His fondness for books had led his aunt to encourage the hope that he might be trained for the ministry, and he readily entered into her views.

"But," he says, "my ill health obliged me to turn my

thoughts another way, and, with a view to trade, I learned the modern languages, French, Italian and High Dutch [German], without a master ; and in the first and last of them I translated and wrote letters for an uncle of mine who was a merchant, and who intended to put me into a counting-house in Lisbon."

Indeed, he says a house was actually engaged to receive him there, and everything was nearly ready for his undertaking the voyage when his health so far improved that the idea of the ministry was resumed. During the two years in which he had been kept away from school the boy was thrown almost entirely upon his own resources. It says much for the activity and eagerness of his mind, his diligence and his power of mental acquisitiveness, that he should have neglected no opportunity of gaining knowledge from the various heretical divines who came to drink a dish of tea with his aunt. He tells us that from Mr Haggerstone, a Dissenting minister in the neighbourhood, who had been educated under Maclaurin, and whom he visited twice a week, he learned geometry, algebra and various branches of mathematics, theoretical and practical. He also read, with but little assistance from him, Gravesend's *Elements of Natural Philosophy*, Watts's *Logic*, and Locke's *Essay on the Human Understanding*. "He also gave lessons in Hebrew to a Baptist minister at Gildersome, a village about four miles from Leeds, and by that means made himself 'a considerable proficient in that language.'" "At the same time I learned Chaldee and Syriac, and just began to read Arabic."

As his knowledge increased, and the powers of his intellect strengthened, he began to exercise his reason

upon the many problems of doctrine and religious belief which could not fail to be uppermost in his mind when his upbringing and the environment in which circumstances had placed him are considered. His aunt, although a strict Calvinist, was a large-minded woman, and, as her nephew says, "far from confining salvation to those who thought as she did on religious subjects."

"Her home," he says, "was the resort of all the dissenting ministers in the neighbourhood, without distinction, and those who were the most obnoxious, on account of their heresy, were almost as welcome to her, if she thought them honest and good men (which she was not unwilling to do), as any others."

Although all the religious books that came in his way tended to confirm him in the principles of Calvinism, he was led by the natural vigour of his mind, and by an innate spirit of philosophical optimism, which strengthened with advancing years, to feel a repugnance to its gloomy tenets, and to question the sufficiency and reasonableness of much of its doctrine. The conversation of the heretical divines in whose company he was thrown served, moreover, to awaken inquiry and to increase his doubts. These divines were for the most part men who, in liberality of thought, were far in advance of the congregations they served, and this was especially the case of those for whose attainments and character the discerning boy had most respect.

The youth, who as a child had lisped at his mother's knee, "without missing a word," the formularies of the Assembly's Catechism, was now tortured with doubt and misgiving as he strove to penetrate into and to realise the meaning of the phrases his memory so tenaciously retained. And the more he read and the more he pondered the more disquieted he became.

“Having,” he says, “read many books of *experiences*, and, in consequence, believing that a *new birth*, produced by the immediate agency of the Spirit of God, was necessary to salvation, and not being able to satisfy myself that I *had* experienced anything of the kind, I felt occasionally such distress of mind as it is not in my power to describe, and which I still look back upon with horror. Notwithstanding I had nothing very material to reproach myself with, I often concluded that God had forsaken me, and that mine was like the case of Francis Spira, to whom, as he imagined, repentance and salvation were denied. In that state of mind I remember reading the account of the man in the iron cage in the *Pilgrim’s Progress* with the greatest perturbation.”

“I imagine,” he continues, “that even these conflicts of mind were not without their use, as they led me to think habitually of God and a future state. And though my feelings were then, no doubt, too full of terror, what remained of them was a deep reverence for divine things, and in time a pleasing satisfaction which can never be effaced, and I hope was strengthened as I have advanced in life and acquired more rational notions of religion. The remembrance, however, of what I sometimes felt in that state of ignorance and darkness gives me a peculiar sense of the value of rational principles of religion, and of which I can give but an imperfect description to others.”

At the time he was greatly distressed that he could not feel a proper repentance for the sin of Adam, taking it for granted, he says, that without *this* it could not be forgiven him. The fact was that, under the influence of his friends, Haggerstone and Walker, he was insensibly following Baxter in attempting to reconcile the doctrines of Arminius and Calvin, and he ended by embracing those of Arminius. It was repugnant to his sense of equity and justice that, in the words of his Catechism, “All mankind, by the fall of our first parents, lost communion with God, are under his wrath and curse, and so made liable to all miseries in

this life, to death itself, and to the pains of hell for ever."

His first trial of faith came when he applied for admission as a communicant in the congregation which he had always attended. The old minister was willing enough to receive him, but the elders, who had the government of the church, discovering this unsoundness on the subject of the sin of Adam, stoutly refused to sanction his admission.

Whilst the taint of heresy appears not to have greatly distressed the worthy Mrs Keighley, it doubtless added to her difficulties in shaping his course towards the ministry. In the natural order of things he was to have been sent to the academy at Mile End, a hot-bed of Calvinism, then under the care of Dr Cawder.

"But," he says, "being at that time an Arminian, I resolutely opposed it, especially upon finding that if I went thither, besides giving an *experience*, I must subscribe my assent to ten printed articles of the strictest Calvinistic faith, and repeat it every six months."

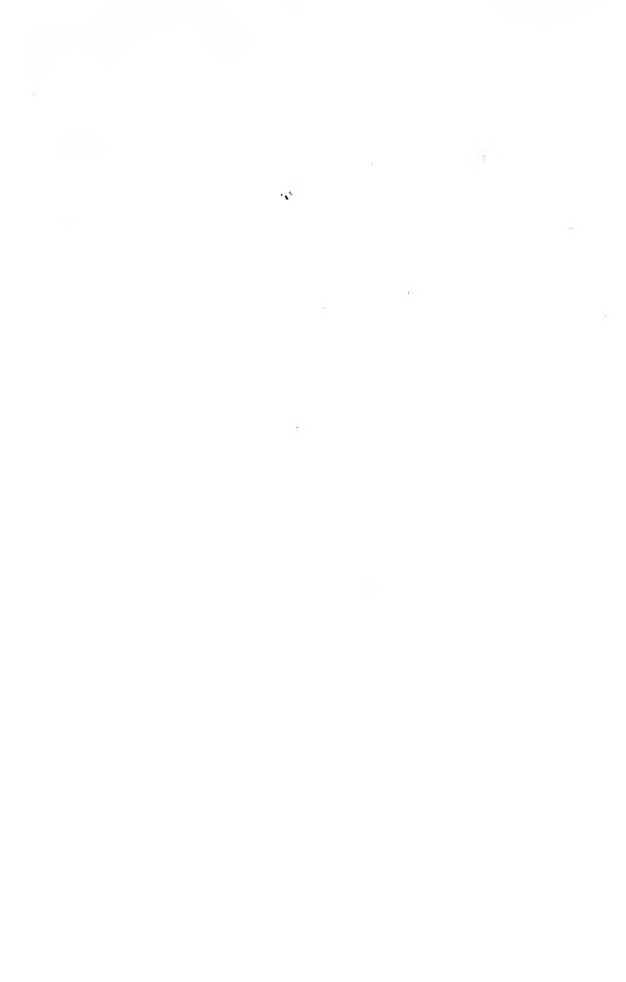
It now looked as if the idea of the ministry was to be given up for good and all, and given up it probably would have been but for the intercession of Mr Kirkby, who strongly recommended that he should be placed under the care of the good and learned Dr Doddridge.

"Mr Kirby," says Priestley, "had received a good education himself, was a good classical scholar, and had no opinion of the mode of education among the very orthodox Dissenters, and being fond of me, he was desirous of my having every advantage that could be procured for me. My good aunt, not being a bigoted Calvinist, entered into his views."

Priestley had another ally in his step-mother, for his

father had married again. She was a woman of good sense as well as of religion, and had been sometime housekeeper to Dr Doddridge, of whom she had a high opinion, and had always recommended his academy.

To Dr Doddridge, however, he was not destined to go. That eminent divine was in the last stages of the malady to which he eventually succumbed, and he died at Lisbon in the October of 1751.



CHAPTER II

Enters the Daventry Academy to be trained for the Ministry
—Goes to Needham Market—His Life, Work and
Privations there.

ACCORDINGLY, in 1752, he was sent to Daventry, then under the charge of Mr Ashworth. He was now nineteen. Although of a weakly constitution, his health was sufficiently re-established to enable him to stand the strain of preparation for the calling to which he now assiduously devoted himself. In mental equipments he was so much in advance of his fellows that he was excused all the studies of the first year and a great part of those of the second. He remained at the Academy three years.

No student ever dwelt more fondly on the memory of his *Alma Mater* than did Priestley on Daventry and all that it meant to him. Its atmosphere was wholly congenial to him, steadying, stimulating and strengthening the naturally vigorous powers of his mind. It was, he says, peculiarly favourable to the serious pursuit of truth, and every question of much importance, such as liberty and necessity, the sleep of the soul, and all the articles of theological orthodoxy and heresy were the subjects of continual discussion between the teachers and the taught. The general plan of studies was exceedingly favourable to free inquiry: the students were referred to authors on both sides of every question and were required to give an account of them, abridging the more important for future use.

Concerning this small seminary for the training of Dissenting ministers, the Rev. Mr Hargrove in his account of Priestley in the *Inquirer* of 1904, says :¹—

“A miserable little place it must have seemed to the eyes of neighbouring clergy, with nothing in it of the venerable traditions, the ancestral wealth, the beauty and the dignity of the old colleges at Oxford and Cambridge. There was nothing grand about this building, nor did any sacred associations hallow its homeliness. But while the lamp of learning burnt low in the ancient universities during the eighteenth century, their gates kept fast closed against all who were too intelligent not to doubt the doctrines of the Established Church, or too honest to conceal their doubts, it burnt bright and clear, tiny though the flame might be, in obscure and poor haunts like this of Daventry. As Priestley proudly, and not untruly, boasted, at a later time, to the Prime Minister of England:

“‘Shutting the doors of the universities against us, and keeping the means of learning to yourselves, you may think to keep us in ignorance and so less capable to give you disturbance. But though ignominiously and unjustly excluded from the seats of learning, and driven to the expedient of providing at a great expense for scientific education among ourselves, we have had this advantage, that our institutions, being formed in a more enlightened age, are more liberal and therefore better calculated to answer the purpose of a truly liberal education. Thus while your universities resemble pools of stagnant water secured by dams and mounds, ours are like rivers which, taking their natural course, fertilise a whole country.’”

The manner in which he occupied his time, the range of his studies, and the miscellaneous nature of his reading at Daventry, may be seen from his following extract from his journal for 1755 :—

BUSINESS DONE IN JANUARY, FEBRUARY AND MARCH

Practical

Howe's Blessedness of the Righteous; Bennel's Pastoral Care; Norris's Letters and Some Sermons.

¹ *The Inquirer*, January 16, 1904.

Controversial

Taylor on Atonement; Hampton's Answer; Sherlock's Discourse, vol. i.; Christianity not founded in Argument; Doddridge's Answer; Warburton's Divine Legation; Benson on the First Planting of Christianity; King's Constitution of the Primitive Church.

Classics

Josephus, vol. i. from p. 39 to 770; Ovid's Metamorphoses, to p. 139; Tacitus's History, Life of Agricola, and Manners of the Germans.

Scriptures

John the Evangelist; The Acts of the Apostles; The Epistles to the Romans, Galatians, Ephesians; 1 and 2 Corinthians, in Greek; Isaiah to the 8th chapter, in Hebrew.

Mathematics

Maclaurin's Algebra, to part ii.

Entertaining

Irene; Prince Arthur; Ecclesiastical Characters; Dryden's Fables; Peruvian Tales; Voyage round the World; Oriental Tales; Massey's Travels; Life of Hai Ebn Yokdam; History of Abdallah.

Composition

A Sermon on the Wisdom of God; An Oration on the Means of Virtue; 1st vol. of the Institutes of Natural and Revealed Religion.

With one of his classmates he engaged to rise early and so "dispatched many articles of business every day. One of them, which continued all the time we were at the academy, was to read every day ten folio pages in some Greek author, and generally a Greek play in the course of the week besides. By this means we became very well acquainted with that language and with the

most valuable authors in it. . . . My attention was always more drawn to mathematical and philosophical studies than his was."

Throughout the whole of his time at the academy, and despite the attractions which scholarship and literary studies had for him, and notwithstanding his eagerness to satisfy "the immense range of his curiosity in all things, physical, moral or social," he never, he says, lost sight of the great object of his studies, which was the duties of a Christian minister.

"There it was that I laid the general plan which I have executed since. Particularly I there composed the first copy of my *Institutes of Natural and Revealed Religion*, Mr Clark, to whom I communicated my scheme, carefully perusing every section of it and talking over the subject of it with me.

What three years of this mental, moral and intellectual discipline meant to the young Arminian may be summed up in his own words: he saw reason to embrace what he says is usually called the heterodox side of almost every question. And this notwithstanding that Dr Ashworth was earnestly desirous of making him as orthodox as possible.

"Notwithstanding the great freedom of our speculations and debates, the extreme of heresy among us was Arianism; and all of us, I believe, left the academy with a belief, more or less qualified, of the doctrine of *atonement*."

Priestley, even at this early stage in his career, gave abundant proof of that resolute regard for truth which constituted the motive power of his life. His sturdy independence of thought, and his almost passionate resentment of dogmatic authority—among the most significant of his intellectual traits—were plainly manifested in his youth and early manhood. They continued to

the end to be the dominant notes of his character and to be the springs of his action. They were at once the sources of his strength and the causes of his misfortunes.

Priestley had now finished with Daventry. He was twenty-two years of age, and ready, and indeed eager, to minister in all the glory of a full-bottomed wig to any congregation that might solicit his services.

The young divines at the academy were an unworldly set, taking but little thought of their future situations in life. They often, indeed, amused themselves, as Priestley tells us, with the idea of their dispersion in all parts of the kingdom, after living so happily together, and with the *camaraderie* of youth used to propose plans of meeting at certain times, and smile at the different appearances they would probably make after being ten or twenty years settled in the world.

Priestley set out on his career with the highest ideal of his calling; indeed to him the office of a Christian minister was the most honourable of any on earth, and he had no other ambition than to distinguish himself by his application to the studies proper to that profession. That he laboured unselfishly and with no idea of place and preferment is certain from the circumstance that he suffered from a physical disability which he must have recognised could not but tell strongly against his chance of worldly success. He had an inveterate stammer which, at times, made preaching as irksome to him as it was trying to those who had to listen to him. In spite of many and repeated attempts he never wholly overcame this trial. And yet nothing is more characteristic of him than, as he reviewed his career in the evening of his life, he should see that, like St Paul's thorn in the flesh, his impediment had not been without its use.

“Without some such check as this,” he says, “I might have been disputatious in company, or might have been seduced by the love of popular applause as a preacher ; whereas, my conversation and my delivery in the pulpit having nothing in them that was generally striking, I hope I have been more attentive to qualifications of a superior kind.”

The thorn in the flesh was probably not without its use in other ways. It probably drove him to literature. If he had none of the graces of pulpit oratory, he had at least the gift of facile composition. If he could not hope to move men’s minds by oral appeals, he might aspire to sway them by the power of the pen.

His first call came from an inconsiderable congregation at Needham Market in Suffolk. It was a poor and needy place, nominally under the charge of a superannuated minister, the prospects bounded by the possibilities attaching to a stipend of forty pounds a year. And these prospects, limited as they were, were still further curtailed by Priestley’s own action. He found that his congregation had been used to receive assistance from both Presbyterian and Independent funds. Priestley was no longer in the mood to receive assistance from the Independents, and told his congregation that he “did not choose to have anything to do” with that body. That little difference between the elders and himself concerning the sin of Adam and its consequence, together with his three years’ sojourn at Daventry, were beginning to bear fruit. The congregation readily consented to give up the Independent fund and promised to make good the deficiency themselves. Priestley, however, quickly realised that they deceived themselves either as to their ability or their willingness to redeem this promise, for the most, he says, he ever received from

them was in the proportion of about thirty pounds per annum. They also deceived him in another sense. Their readiness in consenting to do without the assistance of the Independents disposed him to think "they could not have much bigotry among them." Although he made it a rule to introduce nothing in the pulpit that could, or should, lead to controversy, he made no secret of his real opinions in conversation, or in his lectures on the theory of religion which he had composed at the academy and which he proceeded to give to all persons, without distinction of sex or age, who chose to come and listen to him. He then found that when he came to treat of the Unity of God merely as an article of religion his hearers were attentive to nothing but the soundness of his faith in the doctrine of the Trinity, and they quickly discovered, what he was at no pains to conceal, that he was a very pronounced Arian. From the time of this discovery, he says, his hearers fell off apace, especially as the old minister, as might have been expected, took a decided part against him. To add to his difficulties his aunt stopped his remittances. This was in part due to the ill offices of his orthodox, *i.e.*, Independent, relations, but mainly because the worthy Mrs Keighley had largely exhausted her liberality in supporting others of her needy dependants, and in particular a deformed niece, her constant companion, and who could not, Priestley thinks, have subsisted without the greatest part, at least, of all she had to bequeath. He himself was the first to recognise that, being apparently settled in the world, he ought to be no longer burdensome to her. She had spared no expense in his education, and that, he says, was doing more for him than giving him an estate. Whatever the world might

have thought as to his being settled in it, it had little to offer him beyond the dignity of his profession, and it is difficult to live on dignity alone. The respectable and agreeable families in the place, to whom he had flattered himself he would be useful, were not very prompt to support that dignity, and eventually it had to sustain itself on the wages of an agricultural labourer. Indeed, he says, had it not been for the good offices of Dr Benson and Dr Kippis, eminent eighteenth century divines, who procured him "now and then an extraordinary five pounds from different charities," he believed he should have starved.¹

"At Needham" he says, "I felt the effect of a low, despised situation, together with that arising from the want of popular talents. There were several vacancies in congregations in that neighbourhood where my sentiments would have been no objection to me, but I was never thought of. Even my next neighbour, whose sentiments were as free as my own, and known to be so, declined making exchanges with me, which, when I left that part of the country, he acknowledged was not owing to any dislike his people had to me as heretical, but for other reasons, the more genteel part of his hearers always absenting themselves when they heard I was to preach for him. But visiting that country some years afterwards, when I had raised myself to some degree of notice in the world, and being invited to preach in that very pulpit, the same people crowded to hear me, though my elocution was not much improved, and they professed to admire one of the same discourses they had formerly despised."

The iron would have entered the soul of a weaker

¹ Dr Andrew Kippis, an eminent Presbyterian, was the minister of the Prince's Street Chapel, Westminster, and had at his disposal funds which he could employ in assisting young ministers in their education and first settlement. Priestley enjoyed his friendship through life. Kippis, who was the editor of the *Biographia Britannica*, was elected into the Royal Society in 1779, and served on its council.

man, but Priestley, true to himself, never lost hope or faltered in his courage. However short his commons, Providence had endowed him with the continual feast of a contented mind. He firmly believed, even during the darkest hours of that Suffolk time, that this same wise Providence was disposing everything for the best. Notwithstanding his unfavourable circumstances, "I was," he says, "far from being unhappy at Needham." He boarded with a family for whose kindness he was always grateful. He had free access to one or two private libraries in the district, in particular one belonging to Mr Alexander, a Quaker.

"Here it was," he says, "that I was first acquainted with any person of that persuasion; and I must acknowledge my obligation to many of them in every future stage of my life. I have met with the noblest instances of liberality of sentiment and the truest generosity among them."

There can be little doubt, however, in spite of his robust optimism and the courage with which he confronted the world, the young divine led a cheerless and solitary existence at Needham. And it is no less certain that it was during this dark and troubled time that he sowed the seed—the wheat and the tares—which in the fulness of time was to furnish the harvest of good and evil he eventually garnered—fame, obloquy, insult, persecution, respect, affection and his position among the immortals.

Although the account which Priestley has left us of his life and work at Needham is somewhat meagre, it is sufficiently full to enable us to trace in it the initial stages of his evolution as a theological thinker. Indeed, he says his studies at this period were chiefly theological, theology being the business of his life and the

vocation to which he had been called. He had left the academy with a qualified belief in the doctrine of atonement, and as he was desirous of getting some more definite ideas on the subject he set himself to peruse the whole of the Old and New Testament and to collect from them, with the greatest care, all the texts that appeared to him to have any relation to the subject, and to arrange them under a great variety of heads.

“The consequence of this was,” he says, “what I had no apprehension of when I began the work, viz., a full persuasion that the doctrine of atonement, even in its most qualified sense, had no countenance either from Scripture or reason.”

He then proceeded to digest his observations into a regular treatise, a part only of which was at that time published, under the title of the *Doctrine of Remission*. The portion omitted had reference to an examination of the writings of the Apostle Paul, whose reasoning, he was satisfied, was in many places far from being conclusive. This examination grew into a separate work, in which he tested every passage in which the reasoning appeared to him to be defective or the conclusions ill-supported; and, as he says, he thought them to be pretty numerous.

His friend Kippis advised him to publish this treatise under the character of an unbeliever, in order to draw the more attention to it.

“This” he says, “I did not choose, having always had a great aversion to assume any character that was not my own, even so much as disputing for the sake of discovering truth. I cannot ever say that I was quite reconciled to the idea of writing to a fictitious person, as in my *Letters to a Philosophical Unbeliever*, though nothing can be more innocent, or sometimes

more proper, our Saviour's parables implying a much greater departure from strict truth than those letters do. I therefore wrote the book with great freedom indeed, but as a Christian and an admirer of the Apostle Paul, as I always was in other respects."

When nine sheets of the work were printed off, Dr Kippis dissuaded him from proceeding, or indeed from publishing anything of the kind, until he should be more known and his character better established, and accordingly he desisted. All that he considered of consequence in this work he subsequently inserted in the *Theological Repository*, "in order to its being submitted to the examination of learned Christians."

Another task that he imposed on himself at Needham, and in part executed, was an accurate comparison of the Hebrew text of the Hagiographa and the Prophets with the version of the Septuagint, noting all the variations.

It was, perhaps, in connection with this inquiry that his name appears in the second list of subscribers to Taylor's *Hebrew Concordance*, the second volume of which was published in 1757. The subscription was three guineas, a very considerable sum to the young divine in those days. The fact that he should have entered his name at all is an indication of the ardour and spirit of self-sacrifice with which he invariably pursued his inquiries, whether theological or scientific.

Priestley, to the end of his days, cared little for money except as the means of procuring the material for his investigations, and he was always ready to part with it, to the extent of his opportunity, in any cause in which his sympathies were enlisted.

His circumstances were now so straitened that, despite the great aversion which he conceived he had to

the business of a schoolmaster—having often said that he would have recourse to anything else for a maintenance in preference to it—he was at length compelled to make some attempt that way. He therefore printed and distributed proposals to teach classics, mathematics, etc., for half a guinea a quarter, and to board the pupils in the house with himself for twelve guineas a year. It was recognised that he was not unqualified for this work, but although there was no obvious connection between Arianism and arithmetic it was enough that he was tainted with heresy, and not a pupil was entrusted to his care.

He then proposed to give lectures to grown persons on such branches of science as he could procure the means of illustrating, and began with a course of twelve lectures on the use of “A New and Correct Globe of the Earth.” His one course of ten hearers did little more than pay for his globes.

At this juncture a distant relative procured him an opportunity of preaching as a candidate at Sheffield, but his trial sermon was not approved: his manner was thought “too gay and airy.” One of the ministers at Sheffield had, however, more discrimination, and by his good offices he was recommended to a congregation at Nantwich, in Cheshire, who gave him an invitation to preach there for a year certain. Accordingly, he put together his few worldly possessions—his globes, his beloved books, his stock of sermons, and the manuscripts of the theological treatises he was too poor or too diffident to give to the world—and took the Ipswich packet to London as the least expensive way of getting down to Cheshire.

The chapel in which Priestley preached at Needham

was taken down and rebuilt in 1837. When Rutt was preparing his edition of Priestley's *Memoirs*, his daughter, Mrs Notcutt, who lived in Ipswich, made inquiries respecting Priestley, but with no result.

No reminiscences of him could be found at Needham. He was evidently thought too poor and too obscure for his memory to be treasured.

CHAPTER III

Goes to Nantwich—Starts a School—Is appointed a Tutor in the Warrington Academy—Life at Warrington.

PRIESTLEY left Needham Market in 1758. He had been there three years, and he was in his twenty-fifth year when he entered upon his work at Nantwich. Of this place he had always the happiest recollections. The meeting-house, as we learn from Partridge's *Historical Account of Nantwich*, 1774, was a good, decent building, "to which appertains a convenient house for the minister." Whether he actually occupied this house is uncertain. One account states that he boarded with Mr John Eddowes, a grocer, and sometimes showed his agility and sprightliness by leaping over the counter. Eddowes was described by Priestley as a very sociable and sensible man, and as he was fond of music his guest was—

"Induced to learn to play a little on the English flute, as the easiest instrument ;" and, he continues, "though I was never a proficient in it, my playing contributed more or less to my amusement many years of my life."

And he adds,—

"I would recommend the knowledge and practice of music to all studious persons ; and it will be better for them if, like myself, they should have no very fine ear or exquisite taste, as by this means they will be more easily pleased and be less apt to be offended when the performances they hear are but indifferent."

At Nantwich he found the people good-natured and friendly, and happily free from those controversies which had been the topics of almost every conversation

in Suffolk. He had indeed little mind for them himself. His congregation never exceeded sixty persons, and a great proportion of them were travelling Scotchmen, men, he says, of very good sense, and, what he thought extraordinary, not one of them at all Calvinistical. As there were few children in the congregation there was little scope for exertion with respect to his duty in catechising.

As the duties of his office left him ample opportunity to turn the active powers of his mind to account, he again attempted to establish a school, and this time with a success far beyond his anticipations.

“My school,” he states, “consisted of about thirty boys, and I had a separate room for about half a dozen young ladies. Thus I was employed from seven in the morning until four in the afternoon, without any interval except one hour for dinner, and I never gave a holiday on any consideration, the red-letter days, as they are called, excepted. I had, therefore, but little leisure for reading or for improving myself in any way, except what necessarily arose from my employment.”

Priestley, in truth, was an excellent teacher, and with the success which his efforts brought him there passed away the last traces of the aversion with which he had entered on that calling. He made it his study to regulate his business as a schoolmaster in the best manner, and he was able to say with truth that in no school was more business done, or with more satisfaction, either to the master or the scholars, than in this school of his.

He was no longer haunted, as at Needham, with the fear of debt, and he was able to add to his stock of books and to gratify his wish to possess some philosophical instruments, such as a small air-pump

and an electrical machine, which he taught his pupils to use and to keep in order, and by entertaining their parents and friends with experiments he added greatly to the reputation of his school. At that time, however, he had no leisure to make any original observations.

Such leisure as he had he gave to literature, recomposing his *Observations on the Character and Reasoning of the Apostle Paul*, which he began at Needham, and compiling an English grammar for the use of his school, on a new plan. This work, which was printed in 1761, had a considerable reputation in its day. David Hume acknowledged to Griffith, the bookseller, that he was made sensible of the Gallicisms and peculiarities of his style on reading it.

Priestley remained three years at Nantwich. His success there as a teacher induced the trustees of the newly-founded academy at Warrington to reconsider the desirability of engaging him as tutor in the Classical Languages and in what used to be called Polite Literature. His name had already been mentioned in connection with the Warrington Academy by his friend, Clark of Daventry, at the time of its establishment and whilst he was at Needham.

“But,” says Priestley, “Mr (afterwards Dr) Aikin, whose qualifications were superior to mine, was justly preferred to me.” On the death, on March 5, 1761, of Dr John Taylor of Norwich, the learned author of *A Hebrew Concordance* and other theological works, and a well-known classical scholar, the head of the academy and its tutor of divinity, Dr Aikin was appointed to succeed him, and Priestley was invited to take Dr Aikin’s place.

“This,” says Priestley, “I accepted, though my school

promised to be more gainful to me. But my employment at Warrington would be more liberal and less painful. But, as I told the persons who brought me the invitation, I should have preferred the office of teaching the Mathematics and Natural Philosophy, for which I had at that time a great predilection."

Priestley's removal to Warrington, in September 1761, was one of the turning-points in his career, and no single circumstance in it exercised a greater influence on his life and fortunes. "The Warrington Academy for the education of young men of every religious denomination for the Christian ministry, or as laymen," and the men who formed its tutors, played a notable part in the history of Nonconformity in England. In Taylor of Norwich; in Aikin, the father of the well-known physician and lecturer on Natural History, and of Anna Lætitia, better known as Mrs Barbauld, the poetess; in John Reinhold Forster, the naturalist, who accompanied Cook in his second voyage; in Nicholas Clayton, who succeeded Aikin as divinity tutor; in William Enfield, the author of the *History of Liverpool* and the well-known compiler of *The Speaker*, who afterwards became *Rector Academiæ*; in Pendlebury Houghton, and in Gilbert Wakefield, the accomplished editor of *Lucretius*, Priestley had for colleagues or successors as eminent a set of teachers as any place of learning at that time could boast of. It was at the Warrington Academy, the successor of the older academies belonging to the English Presbyterian body at Findern and Kendal, and the direct ancestor of the Manchester College at Oxford, that the free thought of English Presbyterianism first began to crystallise into the Unitarian theology, and for a time it was the centre of literary taste and activity, and of political liberalism

of the district in which it was placed—the Areopagus in the Athens of Lancashire, as it was called.

The *Transactions of the Historic Society of Lancashire and Cheshire* (vol xi. p. I, 1858-59) contain “A Historical Sketch of Warrington Academy,” by Mr Henry A. Bright, compiled in great measure from a parcel of papers, letters and memoranda which had belonged to the Rev. J. Seddon, and which had been rescued from the hands of a Liverpool cheesemonger, who was using them for the ordinary purposes of his shop. Among these papers were letters of Priestley, Kippis, Aikin and others of lesser note, all of interest as throwing light on the history of the academy. I am indebted to Mr Bright’s paper for the following account of the character and fortunes of the academy. Mr John Seddon, we learn, was its virtual founder. The letters referred to, as well as the testimony of contemporaries, bear witness to “the concern which he had ever expressed for its support, honour, success; the indefatigable pains which he took for this purpose; the indifference which he showed to fame or censure, to good or evil report, so that he might serve the general designs of the institution.”

Seddon, although described as “a dullish person,” must have been a man of considerable pertinacity, patience and resource, as shown by the manner in which he steered his venture through the difficulties and dangers incident to its establishment, for he had to contend with the doubts, hesitation and luke-warmness of its professed supporters, and the “pleasing spirit of jealous rivalry” which existed between Liverpool and Manchester as to its locality. Liverpool advanced seven “excellent reasons” why the academy

should *not* be settled at Warrington; of these one of the Manchester party writes:—"Some of them are *false*, others *dubious*, and all, whether true or not, *trifling* and *impertinent*." This "retort courteous" was naturally followed by "Remarks on a letter from the gentlemen in Manchester to the gentlemen in Liverpool, subscribers to the intended Academy," in which "the gentlemen in Liverpool" lose their temper most completely. Every fourth word in the remarks is italicised. "The gentlemen of Manchester," are stigmatised as "the authors of contention and division," and are subjected to much scathing sarcasm. Evidently the omens were not very propitious, but the wordy warfare eventually spent itself. Mr Seddon got his way; the trustees ultimately settled down to business and on June 30, 1757, the academy was duly inaugurated.

Its first home, immortalised by the lines in which Mrs Barbauld bids us

"Mark where its simple front yon mansion rears,
The nursery of men for future years,"

was described, in terms eminently suggestive of the incomparable Mr George Robins, as "a range of buildings" with "a considerable extent of garden ground, and a handsome terrace walk on the banks of the Mersey, possessing altogether a respectable collegiate appearance." The "ugly, mean, old brick house," no longer

"A dim old mansion, hidden half-away
From a dull world grown careless of its fame,"

has been transformed into a place of quiet, old-world dignity, and is now turned to uses worthy of its fame and in harmony with its traditions.

In spite of the seeming unanimity of the trustees, and the zeal and energy of their secretary, Mr Seddon, the fortunes of the Academy were ill-starred from the outset. Dr Taylor, one of the first Arians who ministered to the English Presbyterians, and an erudite and accomplished man—an author so widely read in his day that he is even mentioned by Burns in his *Epistle to John Goudie* :

“’Tis you and Taylor are the chief,
Wha are to blame for this mischief”—

was ill fitted to direct the precarious existence of the enterprise, and the old scholar must have sighed often for the free and independent position, and the dear home among an affectionate people, which he had sacrificed in leaving Norwich for Warrington. Dissensions arose, in the midst of which Dr Taylor died.

Dr Taylor, as already stated, was succeeded as theological tutor by Dr Aikin, who retained that position until his death in 1780.

“Dr Aikin,” says Gilbert Wakefield, “was a gentleman whose endowments as a man and as a scholar it is not easy to exaggerate by panegyric. . . . His intellectual attainments were of a very superior quality indeed. His acquaintance with all true evidences of revelation, with morals, politics and metaphysics, was most accurate and extensive. Every path of polite literature had been traversed by him, and traversed with success. He understood the Hebrew and French languages to perfection, and had an intimacy with the best authors of Greece and Rome superior to what I have ever known in any Dissenting minister from my own experience.”

Under his judicious guidance matters now went more smoothly : indeed, the eighteen or twenty years which followed constituted the golden age of the Academy,

and the brightest and happiest of these were the six years of Priestley's stay.

In the year following Taylor's death the academy moved from the house by "Mersey's gentle current," then, we are told, an uncontaminated stream noted for its salmon, to the new Academy, which is described as a brick building in a quiet and secluded court, with stone copings and a clock and bell turret in the centre, of no great architectural beauty, but not unpleasing with its quaint, old-world look. This, too, was celebrated in verse by Mrs Barbauld :

"Lo! there the seat where science loved to dwell,
Where liberty her ardent spirit breathed."

It exists no longer: municipal improvements have swept it away, and all that remains of Academy Place are the houses at right angles to it where dwelt Priestley and Enfield. As to emoluments, the tutors had each £100 a year from the subscription fund, and "with respect to dwelling houses, are to be at their own expenses." Poor students were exempted from the payment of fees, but richer ones paid two guineas yearly to each of the tutors, who might take boarders into their houses at £15 per annum for those who had two months' vacation, and £18 per annum for those who had no vacation, exclusive of "tea, washing, fire and candles."

If the living at Warrington was plain and the thinking high, there was a degree of decorous gaiety, of refinement, of social charm, "easy, blithe and debonnair," pervading the little community, which, as may be gleaned from the memoirs and reminiscences of the period, impressed and delighted everyone who was witness of

it. Among those who had pleasant memories of the place were John Howard, the philanthropist, whose works on prison reform were printed by Eyres of Warrington under Dr Aikin's superintendence ;¹ William Roscoe, the author of the *Lives of Lorenzo de Medici* and *Leo the Tenth*, who first learned to care for botany from his visits to the Warrington Botanical Gardens, and whose first work, *Mount Pleasant*, was also printed there ; Pennant, the naturalist, whose *British Zoology* and *Tour in Scotland* first saw the light at Warrington ; Currie, the biographer of Burns, etc.

"The tutors in my time," wrote Priestley—"they knew better," said Miss Lucy Aikin, "than to usurp the title of *Professors* "—"lived in the most perfect harmony. We drank tea together every Saturday, and our conversation was equally instructive and pleasing. I often thought it not a little extraordinary that four persons who had no previous knowledge of each other should have been brought to unite in conducting such a scheme as this, and be all zealous *Necessarians* as we were. We were all, likewise, Arians ; and the only subject of much consequence on which we differed respected the doctrine of atonement, concerning which Dr Aikin held some obscure notions. The only Socinian in the neighbourhood was Mr Seddon of Manchester, and we all wondered at him."

Miss Lucy Aikin, the granddaughter of Priestley's colleague, the niece of Mrs Barbauld, and the accomplished authoress of *Memoirs of the Courts of Queen Elizabeth*, and the biographer of Addison, has left us a little sketch of that society in which the early years of her girlhood were spent.

¹ William Eyres of Warrington, who was one of the most remarkable printers of his day, produced a number of works noted for their typographic excellence and beauty. He printed, in addition to the works above mentioned, the first editions of Mrs Barbauld's poems, Gilbert Wakefield's *Lucretius*, and other well-known classics.

"I have often thought," she says, "with envy of that society. Neither Oxford nor Cambridge could boast of brighter names in literature or science than several of those Dissenting tutors—humbly content, in an obscure town and on a scanty pittance, to cultivate in themselves, and communicate to a rising generation, those mental acquirements and moral habits which are their own exceeding great reward. They and theirs lived together like one large family, and in the facility of their intercourse they found large compensation for its deficiency in luxury and splendour."

But we learn there were other attractions in the Warrington circle besides the tutors and their philosophy.

"We have a knot of lasses just after your own heart," writes Mrs Barbauld (then Miss Aikin) to her friend Miss Belsham, "as merry, blithe and gay as you would wish them, and very smart and clever—two of them are the Miss Rigbys."

We are further told the beautiful Miss Rigbys, whose father was "provider of the Commons,"

"made wild work with the students' hearts; and the trustees had to insist that they must be removed from the house if any students stayed there. And so for a time they were, but Mrs Rigby's health fortunately broke down, and the young ladies were brought back again.

"Rousseau's *Heloise*, too, had much to answer for, and at its appearance (so Miss Aikin tells me), 'everybody instantly fell in love with everybody'; and then it was that our poetess, after winning the hearts of half the students, some one or two of whom for her sake lived (I am informed) 'sighing and single,' was carried off to Palgrave by that queer little man whom henceforth she was to 'honour and obey.'"

On another occasion she wrote:—

"Somebody was bold enough to talk of getting up private theatricals. This was a dreadful business! All the wise and grave, the whole tutorhood, cried out, 'It must not be!' The students, the Rigbys and, I must add, my aunt, took the prohibition very sulkily, and my aunt's Ode to Wisdom was the result."

Those wicked Miss Rigbys must have made the life of that “dullish person,” Mr Seddon, who acted as *Rector Academiæ*, and who was responsible for law and order, well-nigh insupportable. On one occasion—perhaps it was to celebrate their return—they asked some of the students to supper.

“Hams and trifles, and potted beef and other luxuries, were placed before them, and the students were asked to help the ladies. But the hams were made of wood, and the trifles were plates of soap-suds, and the potted beef was potted sawdust, and the other luxuries were equally tempting and equally tantalising.”

Nor were the Rector’s feelings likely to be soothed by such letters as the following from Mr Samuel Vaughan of Bristol, sent during the Long Vacation, complaining bitterly of the disappointment he felt as regards the Academy, and the “too great latitude allowed the students” :—

“My son Ben’s expenses during ten months’ absence amounted to £112, and Billy’s to £59, 12s.; this should nearly suffice for the University, and of itself would to many be a sufficient objection, but in my opinion the consequence of the expense is abundantly more pernicious, as it naturally leads to Levity, a love of pleasure, dissipation and affectation of smartness; diverts the attention, and prevents the necessary application to serious thoughts and Study. When I sent my Sons so great a distance, it was with a view to preserve them from the reigning contagion of a dissipated age, to imbibe good Morals, acquire knowledge, and to obtain a manly and solid way of thinking and acting, but they are returned with high Ideas of modern refinements, of dress and external accomplishments, which if ever necessary, yet resumed by them much too soon. As one instance, they think it a Sight to appear without having their hair Frissened, and this must be done by a dresser, even upon the Sabbath. No person can more wish for, and encourage an open and Liberal way of thinking and acting than

myself, yet do I think that day should be kept with Ancient Solemnity, for to say the least, the reverse gives offence to many serious good People, and exhibits an Ill example at a time when Religion is at so low an ebb as to stand in need of every tie and prop (whether real or imaginary) for its support, therefore any relaxation or Innovation under sanction of such a seminary as yours may have the most pernicious tendency, for when restraints even in unessentials are removed they are frequently a clue or gradation to the fashionable levity of the Age and Irreligion."

That the *mauvais quart d'heure* under the ancestral roof was not without its chastening influence on the improvident Ben is evident from the fact that the same post brought the perturbed Rector a letter from him protesting that—

"none of us have been vicious but only gay. . . . Our recreations have been innocent though expensive, but they imagine that they cannot be expensive without being criminal."

However, he expresses contrition and promises amendment, fears that he has encroached on Mr Seddon's goodness and forbearance, and that his conduct may have acted injuriously on the Academy, etc., etc., and winds up by saying that Mr Wilkes will probably get a pardon from the Crown, and that he (Mr Vaughan) does not believe that he ever wrote the *North Briton*—No. 45.

Alas ! Mr Benjamin Vaughan's contrition was very short-lived, for next year that "affectionate but distressed pupil" had to confess to the Rector that he dare not show his accounts to his father.

"My father, last year, was extremely angry at an account I gave him of £112 spent at Warrington—the present sum is £179. Bill disclaims all share in the expenses above £60. I then have £119 to answer for ; I who promised such a strict amendment, and who had as many excuses last year as at

present. I had more journeys, more music, and yet, according to his knowledge, have spent £7 more in my present year of penance, repentance, etc. ! ”

And yet Mr Benjamin Vaughan became a useful member of society, had a seat in the House of Commons, and had the honour of having dedicated to him the *Lectures on History and General Policy*, to which is prefixed an “Essay on a Course of Liberal Education for Civil and Active Life,” to which he had listened as a pupil and which Priestley published in 1788.

Whatever may have been Mr Seddon’s worries he had at least the consolation of a loving wife, although, it is to be feared, she too suffered much at the hands of those terrible Miss Rigbys, and even from Miss Aikin, who was somewhat of a quiz. The daughter of an equerry to Frederick Prince of Wales, she was a very fine lady, and, says Mr Bright, “spelt abominably.”

“Among the Seddon papers is a letter which her husband wrote to her during a short absence in 1766. On the back of his letter Mrs Seddon prepares a rough draft of an answer to her truant husband. The word which puzzles her most is ‘adieu,’ and she has to spell it over three times before she can determine whether the ‘e’ comes before the ‘i,’ or the ‘i’ before the ‘e.’ The knotty point is at last settled and the fair copy written out ; and this, too, her careful husband put away and preserved among his papers.”

I cannot resist quoting the last paragraph of this most charming but laborious letter.

“Let me hear of you as often as you can ; for it does me more good, and has a much stronger affect upon my spirits than either eather or salvolatiley. Adieu, my dear, except the sincerest and best wishes for your health and happiness, of one whose greatest pleasure in this world is in subscribing herself your truly affectionate wife.—J. SEDDON.

“*P.S.*—I shall want cash before you return ; what must I doe ? Pray put me in a way how to replenish. Remember me properly to everybody.”

We cannot, however, concern ourselves at greater length with the life at the Warrington Academy, or dwell much longer on the fortunes of that seat of learning. To do full justice to the theme would need indeed the witty pen which in “Cranford” delineated the social life of a neighbouring town with such inimitable grace and charm.

The worthy Mr Seddon died in 1770, and was succeeded as Rector by Dr Enfield, a man distinguished for elegance of taste and sound literary judgment, and who, on the death, ten years later, of Dr Aikin, became chief tutor. For various reasons, which it is unnecessary to state here, the trustees eventually decided to remove the Academy to Manchester, and Warrington knew it no more after 1786.

During the twenty-nine years of its existence in the latter place some 400 pupils had passed through it—many of them noteworthy men in their day, such as Percival ; the Aikins ; Rigby of Norwich ; Estlin of Bristol ; Sergeant Heywood ; Hamilton Rowan, the Irish rebel ; Malthus, the political economist ; Lord Ennismore ; Sir James Carnegie of Southesk ; Mr Henry Beaton, Mr Pendlebury Houghton and Dr Crompton.

“In looking over the students’ names,” says Mr Bright, “I cannot but notice how many of their descendants are still the staunch supporters of the liberal dissent which was the distinguishing characteristic of the Academy. Some families, like the Willoughbys of Parkham, whose last lord was educated at Warrington, have now died out ; others, like the Aldersons of Norwich, of which family the late judge was a member, have seceded to the Church of England. But we still find united the

lineal and the theological successors of the Academy's students in the Rigbys, the Martineaus, and the Taylors of Norwich, the Heywoods and the Yateses of Liverpool, the Potters of Manchester, the Gaskells of Wakefield, the Brights of Bristol, the Shores of Sheffield, the Hibberts of Hyde, and the Wedgwoods of Etruria." 's

CHAPTER IV

Priestley marries—Is ordained—His Essay on Education—Lectures on History and General Policy—His Chart of Biography—Becomes a Doctor of Laws of the University of Edinburgh—His visits to London—Makes the acquaintance of Dr Price, Canton and Benjamin Franklin—Writes the *History of Electricity*—Is elected into the Royal Society.

PRIESTLEY'S entrance into the Warrington community affected his career in more ways than one. In the first place, the improvements in his worldly prospects enabled him to marry; and in the second he was led to turn his attention to Natural Philosophy, to which, as we have seen, he was already predisposed. The selection of his wife and of his studies influenced the subsequent course of his life profoundly. Why he should have left the sprightly, witty "Nancy Aikin, with the blue and laughing eyes," to be "carried off to Palgrave by that queer little man" whom she had to "honour and obey" as a school-mistress, is one of those inscrutable dispensations which the hymeneal god delights in. That they were the best of friends and had pleasure in each other's society is abundantly evident. Priestley warmly admired her genius: she confessed, indeed, that he first encouraged her to try her 'prentice hand at poetry. She was about eighteen when Priestley first appeared at Warrington, and about ten years his junior, a girl of many personal attractions and, as demonstrated by her writings, of great mental ability and accomplishments. She had been carefully educated by her father, had a considerable knowledge of modern literature, and

was fairly well-read in that of Greece and Rome. Her first volume of poems was printed at Warrington in 1773 and ran through four editions in a year. It was said of her that she roused the admiration of Fox and Johnson, the envy of Rogers and Wordsworth, and the jealousy of Goldsmith; Scott declared she made a poet of him; Brougham eulogised her in the House of Lords, and Mrs Oliphant has paid her a beautiful tribute in her *Literary History of England*.

Miss Lucy Aikin, in her edition of her aunt's collected works, gives a charming description of her as she appeared in early womanhood :—

“She was at this time possessed of great beauty, distinct traces of which she retained to the latest period of her life. Her person was slender, her complexion exquisitely fair, with the bloom of perfect health; her features were regular and elegant, and her dark blue eyes beamed with the light of wit and fancy.”

Not less charming is the testimony of Henry Crabb Robinson, who, in 1805, wrote :—

“Mrs Barbauld bore the remains of great personal beauty.¹ She had a brilliant complexion, light hair, blue eyes, a small, elegant figure, and her manners were very agreeable, with something of the generation then departing. . . . Mrs Barbauld is so well known by her prose writings that it is needless for me to attempt to characterise her here. Her excellence lay in the soundness and acuteness of her understanding, and in the perfection of her taste. In the estimation of Wordsworth she was the first of our literary women, and he was not bribed to this judgment by any especial congeniality of feeling or by concurrence in speculative opinions. I may here relate an anecdote connecting her and Wordsworth, though out of its proper time by many, many years; but it is so good that it ought to be preserved from oblivion. It was after her death that Lucy Aikin published Mrs Barbauld's collected works, of which I gave a

¹ She was then sixty-two, and lived twenty years longer.

copy to Miss Wordsworth. Among the poems is a Stanza on Life, written in extreme old age. It had delighted my sister, to whom I had repeated it on her deathbed. It was long after I gave these works to Miss Wordsworth that her brother said, 'Repeat me that Stanza by Mrs Barbauld.' I did so. He made me repeat it again. And so he learned it by heart. He was at the time walking in his sitting-room at Rydal with his hands behind him, and I heard him mutter to himself, 'I am not in the habit of grudging people their good things, but I wish I had written those lines.'"¹

Priestley's choice fell upon Mary Wilkinson, who was of about the same age as Anna Letitia Aikin. She was the daughter of a well-to-do ironmaster at Wrexham, with whose family he had become acquainted in consequence of the youngest son, William, having been a pupil at his school in Nantwich. He certainly had no reason to regret his choice, whatever Mary Wilkinson might have felt at times in the "cloudy weather" she was destined to go through. It is, of course, idle to speculate "on what might have been if things had been otherwise." The world, at all events, was the richer for the *Hymns in Prose* and the *Early Lessons*, on which Mr Rochemont Barbauld's young charges and many succeeding generations of children were nurtured.

From a worldly point of view Priestley's marriage was not without its advantages to him, immediate and prospective. Mary Wilkinson had all the force of

¹ The lines were the well-known stanza :—

"Life ! We've been long together
Through pleasant and through cloudy weather ;
'Tis hard to part when friends are dear,
Perhaps 'twill cost a sigh, a tear ;
Then steal away, give little warning,
Choose thine own time ;
Say not good-night, but in some brighter clime
Bid me good-morning."

character, and much of the mental and intellectual ability of her father and her brother John, both of whom had a considerable share in the development of the iron industry in this country. Of them Miss Meteyard, in her *Life of Wedgwood*, writes :—

“John Wilkinson and his father Isaac played no unimportant part in the vast industrial movement of their time. Isaac invented and first brought into action the steam-engine blast at his iron works near Wrexham. John, at the same place, as also at Bradley Forge, in Staffordshire, executed all the ponderous castings for the steam engines required in the Cornish mines, as well as those for Boulton and Watt when they first commenced business.”

The father was ruined in one of the commercial crises of which the times were fertile. Of the son we shall hear more as this history proceeds. He was one of the truest and staunchest of the many true and staunch friends Priestley possessed.¹

Priestley was married in 1762, Mr Threlkeld, one of the students at the academy, who subsequently became a well-known Presbyterian divine, notable for his linguistic attainments and his extraordinary power of memory, being his groomsmen. Whatever might be Mr Threlkeld's faculty of recollection it went wholly astray on this occasion, for he became so absorbed in the study of a Welsh Bible he found beside him in the pew that he became quite oblivious to the onerous duties of his office.

¹ He lies buried near Castlehead, in Cartmel, Lancashire, where his monument, a pyramidal mausoleum containing some twenty tons of iron, is a notable feature in the landscape. On it is the following epitaph written by himself :—

“Delivered from persecution of malice and envy here rests John Wilkinson, Iron Master, in certain hopes of a better state and heavenly mansion, as promulgated by Jesus Christ, in whose Gospel he was a firm believer. His life was spent in action for the benefit of man, and he trusts in some degree to the glory of God.”

Of his marriage Priestley characteristically writes :—

“ This proved a very suitable and happy connection, my wife being a woman of an excellent understanding, much improved by reading, of great fortitude and strength of mind, and of a temper in the highest degree affectionate and generous ; feeling strongly for others, and little for herself. Also, greatly excelling in everything relating to household affairs, she entirely relieved me of all concern of that kind, which allowed me to give all my time to the prosecution of my studies and the other duties of my station.”

All accounts we have of Mary Wilkinson are to the same effect. Her great-granddaughter, Madame Belloc, writes :—

“ It is a tradition in the family that Mrs Priestley once sent her famous husband to market with a large basket, and that he so acquitted himself that she never sent him again ! Mrs Priestley was extremely intelligent and original. Lord Shelburne once found her sitting on the top of a pair of steps, clad in a great apron, and vigorously pasting on a new wall-paper. She received him with calm composure. There is a good portrait of her as an elderly lady in a cap, curving her hand round her ear to assist her hearing. She must have herself insisted upon being painted in this unusual attitude. She looks like a person of excellent understanding, whose mind has been much improved by reading.”

Before he committed himself to matrimony Priestley took another step hardly less momentous.

What it was may be gleaned from the following extract of a letter dated May 1, 1762, to Seddon, who was away at the time on one of his frequent begging expeditions on behalf of the Academy :—

“ I am seriously preparing for *ordination*. As all things in this world are uncertain, I think it a point of prudence not to omit anything that may possibly be of advantage to me, if ever it be my lot to be obliged to have recourse to the ministry for the whole or any part of my subsistence, particularly as I am

going to have a dearer and more important stake in this world than I have ever yet had in it. I can sincerely say I never knew what it was to be anxious on my own account, but I cannot help confessing I begin to feel a good deal on the account of another person. The hazard of bringing a person into difficulties which she cannot possibly have any idea or prospect of affects me, at times, very sensibly."

The earliest known portrait of Priestley is of this period. It represents him as a slender young man with sloping shoulders, with a keen, intelligent eye and an expression not unlike that caught by Fuseli at a later time; his long neck is swathed in the ample folds of a white neck-cloth, and he wears a full-bottomed wig.¹ During Priestley's residence at Warrington an artist was employed in making silhouettes of the principal inhabitants. Many of these were published by Dr Kendrick in his *Profiles of Warrington Worthies*. In that of Priestley the features are delicate and almost feminine: the full-bottomed wig is very much in evidence.

Priestley brought his young bride to "the good dwelling-house neatly filled up, handsomely sashed to the front, with a flight of five steps to the entrance, three storeys high, four rooms on a floor, cellared under, with convenient kitchens, yards and out-offices," over which she was to preside for the next five years. To add to her responsibilities she was promptly charged

¹ This portrait was formerly in the possession of Mrs Crouch, Priestley's youngest sister, and, according to Mrs Bilbrough of Gildersome (*née* Ellen Priestley), was brought by Mrs Crouch, "along with the old family clock from her father's, Fieldhead, when she came to live here in 1787." The picture was once placed in the window of a carver and gilder's shop at Leeds, when Priestley stopped to look at it in passing by. A woman happened to be doing the same, and, on seeing him, exclaimed, "Why, here's the fellow himself!" A photographic copy of it was presented to the subscribers to the Stephen Statue in the Oxford Museum.

with the care of the gay but improvident Mr Ben Vaughan and his brother Bill, and "received the very moderate compensation of fifty pounds a year for each son."

Priestley's house in Academy Street still remains, and the fact that he occupied it until his removal in 1767 is commemorated by a bronze tablet affixed to its walls by the members of the Warrington Society on the hundredth anniversary of his death.

There is a local tradition that an adjoining building was used by him as a laboratory, although it is difficult to find any grounds for the belief. There is no mention of experimental work at this time in his memoirs or correspondence, and whatever he might have done in this direction for his own amusement or the instruction of his pupils needed no special apartment.¹

Lectures on chemistry were, however, given at the academy by Matthew Turner, who is believed to have first turned Priestley's attention to that science. Turner, who practised medicine in Liverpool, although an eccentric man, applied his knowledge of chemistry to industrial purposes, and he is credited with having revived the art of glass-painting.

Priestley was now wholly engrossed in the business of teaching, and although nominally tutor in the classical languages and in the *belles lettres*, there was practically no department of education in which at one time or other during the half-dozen years of his sojourn at Warrington he was not called upon, or did not offer, to instruct. He enlarged and published the *Grammar* to which reference has already been made, and began a

¹ There is a pencil-drawing of the house, made by the son of Dr Kenrick of Warrington, among the Yates papers in the possession of the Royal Society.

treatise on "The Structure and Contemporary State of the English Language," the material for which he eventually gave to Croft of Oxford for the compilation of his *Grammar and Dictionary*.

But what particularly impressed him as a practical educationist was that whilst most of his pupils were designed for situations in civil and active life, every article in the plan of their education was adapted to the learned professions. There was hardly any medium between an education for the counting-house, consisting of writing, arithmetic and merchants' accounts, and a method of instruction in the abstract sciences. He proceeds to trace how this came about :—

"Formerly none but the clergy were thought to have any occasion for learning. It was natural, therefore, that the whole plan of education, from the Grammar School to the finishing at the University, should be calculated for their use. If a few other persons, who were not designed for Holy Orders, offered themselves for education, it could not be expected that a course of studies should be provided for them only. And, indeed, as all those persons who superintended the business of education were of the clerical order, and had themselves been taught nothing but the rhetoric, logic and school-divinity, or civil law, which comprised the whole compass of human learning for several centuries, it could not be expected that they should entertain larger, or more liberal, views of education; and still less that they should strike out a course of study for the use of men who were universally thought to have no need of study, and of whom few were so sensible of their own wants as to desire any such advantages.

"Besides, in those days, the great ends of human society seem to have been but little understood. Men of the greatest rank, fortune and influence, and who took the lead in all the affairs of State, had no idea of the great objects of wise and extensive policy, and therefore could never apprehend that any fund of knowledge was requisite for the most eminent stations in the community. Few persons imagined what were the true

sources of wealth, power and happiness in a nation. Commerce was little understood, or even attended to ; and so slight was the connection of the different nations of Europe that general politics were very contracted. And thus, men's views being narrow, little previous furniture of mind was requisite to conduct them."

These paragraphs constitute the introduction to an *Essay on Education* which Priestley published in 1764, with the object of drawing attention to the necessity for a reform in our educational system. Although written nearly a century and a half ago, Priestley's main contention that the education of youth should be directed and adapted to the circumstances and needs of the time in which they live is just as valid now as then, and needs the same insistence. He points out that "the severe and proper discipline" of the Grammar Schools, which are subservient to the Universities, is become a "topic of ridicule."

"This is certainly a call upon us to examine the state of education in this country, and to consider how those years are employed which men pass previous to their entering into the world ; for upon this their future behaviour and success must, in a great measure, depend. A transition, which is not easy, can never be made with advantage ; and therefore it is certainly our wisdom to contrive that the studies of youth should tend to fit them for the business of manhood ; and that the objects of their attention, and turn of thinking in younger life, should not be too remote from the destined employment of their riper years. If this be not attended to they must necessarily be mere novices upon entering the great world, be almost unavoidably embarrassed in their conduct, and, after all the time and experience bestowed upon their education, be indebted to a series of blunders for the most useful knowledge they will ever acquire."

"That man is a friend of his country who observes and endeavours to supply any defects in the methods of educating youth."

At the risk of being called "a projector, a visionary, or whatever anybody pleases," he proceeds to show "how to fill up with advantage those years which immediately precede a young gentleman's engaging in those higher spheres of active life in which he is destined to move."

It will be observed that Priestley is not dealing with any scheme of national or universal education adapted to every youth in the community. He is concerned only with the young man who is destined for a station in which his conduct may considerably affect the liberty and the property of his countrymen, and the riches, the strength and the security of his country; and who is within the influence of an honourable ambition to appear as a legislator in the State, or of standing near the helm of affairs and guiding the secret springs of Government—in a word, that class which the universities thought they alone were specially concerned with.

"That the parents and friends of young gentlemen destined to act in any of these important spheres may not think a liberal education unnecessary to them, and that the young gentlemen themselves may enter with spirit into the enlarged views of their friends and tutors, I would humbly propose some new articles of academical instruction, such as have a nearer and more evident connection with the business of active life, and which may therefore bid fairer to engage the attention and rouse the thinking powers of young gentlemen of an active genius. The subjects I would recommend are 'Civil History,' and more especially the important objects of 'Civil Policy'; such as the theory of laws, government, manufactures, commerce, naval force, etc., with whatever may be demonstrated from history to have contributed to the flourishing state of nations, to rendering a people happy and populous at home and formidable abroad; together with those articles of previous information, without which it is impossible to understand the nature, connections and mutual influences of those great objects."

He then gives plans and detailed syllabuses of three

distinct courses of lectures subservient to this design. The first is on the "Study of History in General"; the second on the "History of England," and the third on the "Present Constitution and Laws of England." This scheme is so daring an innovation on the established order of things 150 years ago, that Priestley then proceeds with care to anticipate, examine and rebut the objections which may be urged against it. There is no necessity to dwell upon them now. Much water has flowed under the Folly Bridge or past the "Backs" since Priestley's essay was penned, and everything for which he contended, and even more, now finds its proper place in the educational schemes of all our universities, ancient and modern. But it is significant of the condition of things in the older seats of learning in the middle of the eighteenth century, that he should have to urge his project apologetically and to labour points which to-day appear almost axiomatic. The essay is characteristic of the author in the breadth and liberality of its tone, in its declaration of the real functions and objects of government, and in its note of true patriotism. Of course it was fiercely attacked, among others, by Griffiths in the *Monthly Review*, but it enlisted Josiah Wedgwood's sympathy with its author and formed the basis of a friendship as cordial and enduring as it was useful.

The lectures on "History" and on "General Policy" were subsequently published, with a dedication, as already stated, to Mr Benjamin Vaughan. It is interesting at this juncture to learn the views Priestley inculcated on the youth of Warrington concerning other matters which, like the education problem and the poor, are always with us.

In the 51st lecture on "General Policy" we read :—

"The gain of the merchants, it is said, is not always the gain of the country in general. If, for instance, a merchant imports foreign goods by which the consumption of national manufactures is hurt, though the merchant should be gainer by those goods, the State is a loser. As, on the other hand, a merchant may export the manufactures of his own country to his own loss and the nation's gain. But if the merchants be gainers, the consumers, that is those for whose use manufactures are established, having a power of purchasing or not at pleasure, must be so too. And if, after sufficient trial, it be found that merchants importing foreign goods can sell these cheaper than the manufactures can be bought at home, it is an indication that it is not for the interest of the nation at large to encourage such manufactures.

"Though exportation makes a nation rich, we are not to judge of the quantity of riches which a nation gains by trade from exportation only, but the importation must also be considered. If these exactly balance one another nothing can be said to be gained or lost, just as a person is not the richer for selling a quantity of goods if he buy to the same amount. Nay, though the exportation be lessened, if the importation be lessened more than in proportion, it proves an increase of gainful trade, notwithstanding the decrease of exportation. This, however, is estimating the value of commerce by the mere increase of money. But a nation may flourish by internal commerce only, and what is *external* commerce between two nations not united in government would be internal if they should come under the same government. In every fair bargain the buyer and the seller are equally gainers, whether money be accumulated by either of the parties or not.

"It is a great mistake to confound the king's revenue with the gain a nation makes by its trade. No man would presume to say it is more for the public benefit that the nation should expend a million or more every year with foreigners, in order to raise a hundred thousand pounds to the revenue by the customs, than to save that million or more within ourselves and to raise only the hundred thousand pounds the other way. But Ministers of State are apt to estimate the value of everything to the country by the gain it brings, and that immediately to themselves. . . .

“The legislature of any country has seldom interfered in the affairs of commerce, but commerce has suffered in consequence to it, owing to the ignorance of statesmen, and even of merchants themselves, concerning the nature of trade. And indeed the principles of commerce are very complicated and require long experience and deep reflection before they can be well understood. . . .

“Most politicians have injured commerce by restricting, confining or burthening it too much ; the consequence of which has been that by aiming at great immediate advantage they have cut off the very springs of all future advantage. The inconveniences which have arisen to a nation from leaving trade quite open are few, and very problematical in comparison of the manifest injury it receives from being cramped in almost any form whatsoever. . . .

“Mr Colbert, a man of great probity, knowledge and industry . . . would have done better to have listened to the advice of an old merchant, who being consulted by him about what he should do in favour of trade, said, ‘*Laissez nous faire.*’”

In another place he says :—

“The happiness of all nations, therefore, as one great community, will be best promoted by laying aside all national *jealousy of trade*, and by each country cultivating those productions or manufactures which they can do to the most advantage ; and experience, in a state of perfect liberty, will soon teach them what those are. In this state of things the only advantage will be on the side of industry and ingenuity, and no man or nation ought to wish it to be anywhere else.”

With regard to questions of political and civil liberty, the theory of the progress of law, the influence of religion on civil society, the connection of modes of religion with forms of government, the teaching is precisely what we should expect in such a hot-bed of liberal dissent as the Warrington Academy. With regard to the connection between civil government and religion he says :—

“The principal sufferer by this alliance between the Church and the State is religion itself, that is, the members of society as professors of religion and deriving advantages from it. For when it is thus guarded by the State, if it be faulty or wants reformation, it must long continue so. The professors of it, being interested in its support, will do everything in their power to prevent any alteration, though it should be ever so much wanted. . . .

“It is alleged, in favour of these establishments, that religion has an influence on the conduct of men in this life. No doubt it has, as it connects the hopes of a future life with good behaviour in this. But this is done in all sects of Christians, and as much in those which are reprobated by the State as those which are encouraged by it. Besides, if this was the true cause of attachment to Christian establishments, the friends of them would be much more jealous of unbelievers than they are of sectaries, which does not appear to be the case. . . . One would think that Christian Governments might content themselves with establishing the Christian religion in general without confining themselves to any particular mode of it. But so far is this from being the case, that by the present laws of this country a man who denies the doctrine of the Trinity, which has no more imaginable connection with the good of the State than the doctrine of Transubstantiation, is deemed a blasphemer and sentenced to suffer confiscation of goods and imprisonment. . . .

“In all other countries the established religion is that of the majority of the people, and the writers in defence of it vindicate it on this principle, viz., that it is the religion of the majority, whatever that be. But in Ireland we have a most remarkable exception to this rule. There the established religion is not that of the majority but of a small minority of the people, perhaps not more than that of one in ten of the inhabitants. That so flagrant an abuse of power should exist, and under a Government pretending to justice, and even to liberality, is barely credible.”

Here again much water has flowed under the bridges since these words were penned, but the bread which Priestley cast upon the stream, as well as that upon

which he nurtured the young gentlemen of the Warrington Academy, has, we recognise, not been wholly wasted. In regard to what he considered other anomalies, the State still takes upon itself a "great, dangerous and unnecessary burthen" by undertaking the care of religion. From the remains of superstition the clergy are still considered as a distinct order of men in this country, and they are in a manner represented in Parliament by the bishops having seats in the House of Lords. "From which," he says, "if they had a just sense of the nature of their office, and consulted their true dignity, they would retire of their own accord. At present their seat in the House only flatters their pride and gives the minister so many votes."

In regard to other items of political and social development, it is noteworthy that Priestley was a consistent opponent of national education as we understand it to-day, on the ground that in his judgment it was inimical to liberty and the natural rights of parents. His position, in fact, was very similar to that taken up by a considerable and influential section of Liberal Dissenters prior to 1870.

Whilst at Warrington he also gave lectures on the "Theory of Language," on the "Laws and Constitutions of England," and on "Oratory and Criticism"—all of which were subsequently published, and which may still be read with profit, despite Lord Brougham's sneering allusion to the adventurous tutor afflicted with an incurable stutter who, having never heard any speaking save in the pulpits of meeting-houses, promulgated rules of eloquence and of jurisprudence to the senators and lawyers of his country. The adventurous tutor with the incurable stutter even taught Elocution, also Logic

and Hebrew for a time, and one year he gave a course of lectures on Anatomy.

Whilst at Warrington he published a *Chart of Biography*, exhibiting by lines and spaces the succession of the eminent men in every age and of every profession, with the relative length of their lives, and in such manner that at any given epoch it could be seen not only who flourished in it, but how all their ages stood with respect to one another, who were a man's contemporaries, how far any of them was before him, or how far after him, in the order of their births or deaths.

The *Chart of Biography* procured for its compiler the degree of Doctor of Laws of the University of Edinburgh.

It has been said of Priestley that he was not a man who made friends. If it is meant by this that he was essentially a self-centred recluse, who sought his relaxation in change of occupation, or only within his own family circle, the statement gives a wholly imperfect idea of the man and is very wide of the truth.

In reality he was one of the most gregarious and most easily approachable of individuals, a man of strong, active human sympathies and of much social charm. There is abundant evidence of this in the testimony of his contemporaries; it is illustrated by numberless anecdotes, and is reflected in almost every letter of his correspondence.

It was, doubtless, under the impulse of the social instincts of his nature that, whilst at Warrington, he was led to begin the practice of spending one month in every year in London. This, remarks his son, was of great use to him. He saw and heard a great deal. A

new turn was frequently given to his ideas. New and useful acquaintances were formed, and old ones confirmed. London then, as now, was the centre of the intellectual life of the kingdom and the Royal Society the seat of its scientific activity. To a man of Priestley's versatility and eagerness, whose curiosity ranged practically over every department of human knowledge, these annual visits were a sort of intellectual tonic and gave a powerful stimulus to his activity.

On the first of them he made the acquaintance of men who, in their several capacities, proved to be true and valuable friends, notably, Dr Richard Price, Mr Canton, and Dr Benjamin Franklin.

Dr Price, a philosopher, and an eminent nonconformist divine, and one of the leading Arians of his time, is best known by his work on morals, and by his writings on financial and political questions. Among these, his papers in the *Philosophical Transactions* on "Life Insurance" and on the "Proper Method of Calculating the Values of Contingent Reversions," are specially noteworthy. His pamphlet on the National Debt is said to have influenced Pitt in establishing the Sinking Fund for its extinction, and that on the "Policy of the War with America" to have contributed to the declaration of independence by the Americans. His liberal opinions gained him the friendship and patronage of Lord Shelburne. The acquaintance with Priestley soon ripened into a lasting friendship, which was in nowise disturbed by the controversy on materialism and necessity in which they subsequently engaged. Price and Priestley held similar views as to the French Revolution, and both were denounced with equal

fierceness by Burke. Price died in the spring of 1791, and his funeral sermon was preached by Priestley, who succeeded him in the care of the Gravel Pit Meeting at Hackney. He was a man for whom Priestley ever entertained the warmest feelings of friendship on the ground of his amiable simplicity, his truly Christian spirit, disinterested patriotism and true candour.

John Canton, a notable schoolmaster in his day, is best known for his electrical inquiries and for his work on the compressibility of water, and his name is associated with the phosphorescent substance first obtained by him by calcining oyster shells with flowers of sulphur.

Among the Canton papers in the possession of the Royal Society is a letter from Seddon to Canton introducing Priestley, in which the latter is described as the author of *A Chart of Biography* and of an *Essay on Education*, and in which the writer says of the bearer :—

“You will find him a benevolent, sensible man, with a considerable share of learning. Besides the studies which belong to his profession, he has a taste for Natural Philosophy which will not render him less agreeable to you.”

That Priestley greatly enjoyed and profited by his Christmas in London is evident from the terms in which he refers to it in a letter to Canton under date February 14, 1766.

“The time I had the happiness to spend in your company appears upon revision like a pleasing dream. I frequently enjoy it once again in recollection, and ardently wish for a repetition of it. I wish, but in vain, that it may ever be in my power to return in kind your generous communication of philosophical intelligence and discoveries.”

He concludes the letter by expressing a desire to become a Fellow of the Royal Society.

Benjamin Franklin, journeyman printer and journalist, statesman and diplomatist, was about sixty years old when Priestley, then a man of little more than half his age, first made his personal acquaintance. The Royal Society, which had formerly ridiculed the discoveries which have given Franklin his undisputed position as one of the most eminent natural philosophers of his time, had paid him, although still a British subject, the distinguished compliment of making him an honorary fellow. At the time of Priestley's coming to town he was occupied with the great struggle on behalf of the American Colony which ended in the defeat of the Stamp Act, and his famous examination before a Committee of Parliament had made him an object of great popular interest. During the eight or nine succeeding years in which Franklin remained in England his acquaintance with Priestley grew into the closest friendship, and there can be no question that the friendship reacted powerfully on Priestley's work as a political thinker and as a natural philosopher. Indeed, it may be truthfully said that Franklin made Priestley into a man of science.

As the result of this intercourse with Canton and Franklin, Priestley offered to compile what he called "a distinct and methodical account" of the history of discoveries in electricity, provided he could be supplied with the necessary books. Franklin warmly seconded the proposal, and undertook, with the assistance of friends, to furnish all existing literature on the subject. As a matter of fact almost the whole of the historical account in Priestley's book is taken from the *Philosophical Transactions of the Royal Society*, which was then the chief source of information concerning electrical

science, inasmuch as the English electricians of that period, in addition to their own original papers, which were both numerous and important, introduced into the *Transactions* detailed accounts of all the principal books on electricity published abroad. In putting together his work, Priestley, having, as he says, a pretty good machine, was led to endeavour to ascertain several facts which were in dispute, and was thus led by degrees into a large field of experimental inquiry, in which he spared no expense that he could possibly afford. One of the most important of his discoveries is that charcoal is a good conductor. He describes coloured circles produced by receiving discharges from 21 square feet of glass on metal plates. When an electrical battery is discharged light bodies placed near the electric circuit are moved. Priestley ascribes this motion to what he calls the force of the lateral explosion, and he conceives it to depend upon the sudden elasticity given to the air. He found that a long circuit conducts much worse than a short circuit, even when the conductors are the same; also, that when the circuit contains an imperfect conductor a spark passes to bodies near, no electricity being communicated.

The work necessitated much correspondence with Franklin and others of his philosophical friends in London, and much of his leisure was devoted to his own experimental observations. Nevertheless, the book was completed in less than a year. Hasty and imperfect as it was, "*The History and Present State of Electricity. With Original Experiments, illustrated with Copper-plates,*" was well received and ran through five editions in its author's lifetime. Its publication at once stamped Priestley as a man of science; it secured him recogni-

tion as such in scientific circles at home and abroad, and was the immediate cause of his election, on June 12, 1766, into the Royal Society. The growing interest in the subject induced him to put together a *Familiar Introduction to the Study of Electricity*, which had also a considerable measure of success and was the means of popularising a knowledge of the main facts then known concerning Frictional Electricity. Priestley was instrumental in reviving the use of large electrical machines and batteries. The first of the large machines for which Nairne became famous was constructed in consequence of a request made to Priestley by the Grand Duke of Tuscany to procure for him the best machine that could be made in England. One of his machines, which figured in his *History*, and also in his *Familiar Introduction*, is in the possession of the Royal Society.

CHAPTER V

Goes to Leeds as minister of the Mill Hill Chapel—Resumes his studies in Speculative Theology—*The Theological Repository*—Becomes a Unitarian—Priestley as a controversialist—His Theory and Practice of Perspective—His literary characteristics—Begins his inquiries on Pneumatic Chemistry—His invention of soda-water—Receives the Copley Medal of the Royal Society.

ALTHOUGH Priestley lived in philosophic contentment with his lot at Warrington, happy in his occupations and in the society of congenial colleagues, the circumstances of the Academy were not fortunate. The institution never wholly recovered from the unhappy differences between the trustees and the first head of the Educational Staff, and in time many of the subscribers grew lukewarm in their support. Priestley had a remarkable power of adapting himself to his environment ; he was one of the most even-tempered of men and had a capacity for being cheerful that would have extorted admiration even from Socrates. "But," says Miss Aiken, "the Alma Mater of Warrington was ever a niggardly recompense of the distinguished abilities and virtues which were enlisted in her service." One hundred pounds a year, with a house and a few boarders—hungry lads at £15 a year, exclusive of washing and candles—meant little towards the *res angusta domi*. Moreover, little Sarah Priestley had made her appearance, and the uncertain prospects which were before that young lady, coupled with the condition of her mother's health, which was not wholly satisfactory at

Warrington, led him to contemplate the expediency of giving up school-mastering and of resuming his profession of the ministry. Accordingly he was induced to accept an invitation to take charge of the congregation of Mill Hill Chapel, at Leeds, where he was already pretty well known, and thither he removed in 1767.¹

Although it was no part of his duty to preach when at Warrington, he had from choice continued the practice, and wishing to maintain the character of a Dissenting minister, he had, as we have already seen, been ordained whilst there. His tendency to stammer was still a difficulty. Indeed, whilst at Nantwich it was so marked that he had almost resolved to abandon the calling. By reading aloud and very slowly every day, and by taking pains, he in some measure got the better of his defect, but he never wholly overcame it.

At Leeds he found a liberal, friendly and harmonious congregation, to whom his services, of which he was not sparing, were very acceptable. There, he says, he had no unreasonable prejudices to contend with, so that he had full scope for every kind of exertion. His activity and zeal in the special duties of his office led him to prepare and print catechisms for the young and to form various classes of catechumens and to instruct them in the principles of religion. He also published discourses on "Family Prayer," on the "Lord's Supper" and on "Church Discipline," some of which were not altogether to the liking of members of the Established Church. Indeed, the first of his controversial pieces was written in

¹ The Chapel, or "Meeting House" as it was called in Priestley's time, adjoined the Alms House Garth and was erected in 1673, after the passage of the Act of Indulgence. It was pulled down in 1847 and the present Mill Hill Chapel erected on its site.

answer to some angry remarks on one of these discourses written by a clergyman in the neighbourhood.

His return to the active duties of the ministry naturally induced him to resume the studies in Speculative Theology which had occupied him at Needham but which had been in large measure interrupted by the business of teaching at Nantwich and Warrington. He now published his *Institutes of Natural and Revealed Religion*, and began the publication of *The Theological Repository*, a collection of papers on theological questions, contributed by himself and a number of neighbouring ministers and others. The work eventually extended to six volumes, three of which were printed whilst he was at Leeds.

"*The Theological Repository*," says the Rev. Charles Wicksteed,¹ "was one of those publications which will always appear from time to time in every body in which there is much activity and much freedom of thought. It had, however, a very slender circulation, and was very little read by any but theologians of the Liberal school. Indeed, it discussed questions which were viewed with terror by many even of the Liberal school itself, because it, in fact, purposely deserted the beaten track of opinion and opened out those questions on which difficulties began to be felt, or on which fresh light was wanted. It aimed at collecting the contributions of free, independent and thoughtful minds—*towards* correct ultimate decisions, without pretending itself to furnish those decisions. This is ever a position which the bigoted violently resent, which the unlearned cannot understand, on which even the candid and liberal often look with a dissatisfaction not unmingled with fear, but which is, notwithstanding, the essential preliminary of correct settled opinion in every age of thought. It is a position often assumed by the most contemplative and the most thoroughly honest men of the generation, but one which is never understood until the generation which produced and

¹ "Lectures on the Memory of the Just. A Series of Discourses on the Lives and Times of the Ministers of Mill Hill Chapel, Leeds."

neglected it is passed. If there were not this neutral ground on which inquiring spirits can meet, beyond the hackneyed and settled points in which alone the many are interested, there would be an end to thought, which in a short time would prove an end to active, healthy, influential and tested truth."

Shortly after his removal to Leeds, Priestley avowed himself an adherent to that school of theological opinion which its enemies associate with the name of Fausto Sozzini; that is, he became what has been called a *humanitarian*, or a believer in the doctrine that Jesus Christ was in nature solely and truly a man, however highly exalted by God.

Sozzini's doctrine brought down upon its teacher the ill-will of a Cracow mob; his house was wrecked, his books and manuscripts destroyed, his life threatened, and he was driven from the city. Two hundred years later the Socinian Priestley went through precisely the same experience. Wrecking the homes, pillaging the property and injuring the persons of heresiarchs might seem an extraordinary way of identifying oneself with the doctrine of the gentle author of the Sermon on the Mount if history had not made us pretty familiar with such spectacles. At Leeds, as already stated, Priestley published the first of the series of controversial pieces on religion and politics which ceased only with his death. By some strange irony of fate this man, who was by nature one of the most peaceable and peace-loving of men, singularly calm and dispassionate, not prone to disputation or given to wrangling, acquired the reputation of being perhaps the most cantankerous man of his time, who delighted in tilting against established usage, and whose hand, Ishmael-like, was against every man's. By sheer force of circumstances

he became an indefatigable pamphleteer, apparently ever ready to vindicate the cause of civil and religious liberty, to champion the principles and conduct of Dissenters, and to attack what he considered the inveterate prejudices of the prevailing religion of his countrymen.

As a controversialist his methods were beyond reproach, and the arts of casuistry were wholly foreign to his character. He was so obviously sincere and fair-minded that he frequently overcame prejudice and disarmed criticism by his unconscious unwritten appeal to the finer instincts of his adversaries. He made many enemies but he won far more friends : the enemies were for the most part men whom history willingly lets die ; the friends were of every sect, and some of them were among the chief glories of the eighteenth century.

The following characteristic letter to his friend, Miss Aiken, is interesting as illustrating the action of the active, eager mind which, as its owner says, found scope for every kind of exertion at this period of his life :—

“LEEDS, 13th June 1769.

“DEAR MISS AIKIN,—You will be surprised when I tell you I write this on the behalf of *Pascal Paoli* and the brave *Corsicans*, but it is strictly true. Mr Turner of Wakefield, who says he reads your poems, not with admiration, but astonishment, insists upon my writing to you to request that a copy of your poem, called *Corsica*, may be sent to Mr Boswell, with permission to publish it for the benefit of those noble islanders. He is confident that it cannot fail greatly to promote their interest, now that a subscription is open for them, by raising a generous ardour in the cause of liberty and admiration of their glorious struggle in its defence. Its being written *by a lady*, he thinks, will be a circumstance very much in their favour and that of the poem, but there is no occasion for Mr Boswell to be acquainted with your name unless it be your own choice some time hence. I own I entirely agree with Mr

Turner in these sentiments, and therefore hope Miss Aikin will not refuse so reasonable a request, which will, at the same time, lay a great obligation on her friends in England and contribute to the relief of her own heroes in Corsica. Consider that you are as much a general as Tyrtæus was, and your poems (which, I am confident, are much better than his ever were) may have as great an effect as his. They may be the *coup de grace* to the French troops in that island, and Paoli, who reads English, will cause it to be printed in every history of that renowned island.

“Without any joke, I wish you would comply with this request. In this case you have only to send a corrected copy to me at Leeds, to Mr Johnson in London, and I will take care to introduce it to the notice of Mr Boswell by means of Mr Vaughan or Mrs Macauley, or some other of the friends of liberty and Corsica in London. The sooner this is done the better. Mr Turner regrets very much that it was not done some time ago. I shall not tell you what I think of your poems for more than twenty reasons, one of which is that I am not able to express it. We are now all expectation at the opening of every packet from Warrington.

“My piece on Perspective is nearly ready for the press. Come and see us before it is quite printed, and I will engage to teach you the whole art and mystery of it in a few hours. If you come a month after I may know no more about the matter than anybody else. I am about to make a bolder push than ever for the *pillory*, the *King's Bench Prison*, or something worse. Tell Mr Aikin he may hug himself that I have no connection with the Academy. On Monday next Mr Turner and I set out on a visit to the Archdeacon at Richmond.

“With all our compliments to all your worthy family, I am, with the greatest cordiality, your friend and admirer,

“J. PRIESTLEY.”

Pasquale de Paoli, the Corsican patriot, whose struggles to secure the independence of his native island had excited warm sympathy in England and had enlisted the pen of Boswell, was at that time a refugee in this country, having been defeated, after a stubborn resist-

ance, by the French under Count Vaux. The poem on "Corsica," one of the earliest and most beautiful of Miss Aikin's productions, was written in 1768, at about the period of the appearance of Boswell's *Account of Corsica*, but it was first published in 1773 in a collection of her poems, of which four editions, the first in 4to, the three others in 8vo were printed in that year.

The copy seen by Priestley was in manuscript. Whether it was shown to Boswell or to Paoli is not recorded.

The piece on Perspective was published in 1770, under the title of "*A Familiar Introduction to the Theory and Practice of Perspective. With copperplates.*" He gave as his reason for writing it that, having occasion to make drawings of philosophical instruments and apparatus he had felt the need of a work treating of perspective. It will be seen in the various editions of his works that the words "Priestley del" are engraved at the left-hand corner of the copperplates of the illustrations. The book had a considerable sale and was frequently recommended by drawing-masters. A second edition appeared in 1782 and it continued to be used well into the nineteenth century.

It is interesting to note that the first printed account of the use of india-rubber for the purpose of erasing lead pencil marks occurs in the preface to this work. It ran thus :—

"Since this work was printed off I have seen a substance excellently adapted to the purpose of wiping off from paper the marks of black lead pencil. It must therefore be of singular use to those who practise drawing. It is sold by Mr Nairne, mathematical instrument maker, opposite the Royal Exchange. He sells a cubical piece of about half an inch for three shillings, and he says it will last several years."

The "bolder push than ever for the *pillory*, the *King's Bench Prison*, or something worse," probably refers to the anonymous pieces which he published in support of "Wilkes and Liberty" in the course of the memorable struggle between the freeholders of Middlesex and the House of Commons concerning the rights of free representation by parliamentary constituencies which at that time agitated the country. Wilkes had shortly before the date of this letter been fined by the King's Bench £1000 and sentenced to twenty-two months' imprisonment for publishing an impious libel, and had been expelled from the House of Commons—to which, however, he was repeatedly returned by the electors of Middlesex.

The Richmond visit to Archdeacon Blackburne, whose son had been at the Warrington Academy, is memorable from the circumstance that on its occasion Priestley first met Theophilus Lindsey, with whom he contracted an intimate and lasting friendship, which greatly influenced the lives and fortunes of both, and of which Priestley subsequently wrote that it had been a source of more real satisfaction to him than any other circumstance in his whole life.

The busy pamphleteer found time, however, to put together more ambitious works than *Wilkes and Liberty*. The success of his *History of Electricity* induced him to attempt the compilation of the history of all the branches of experimental philosophy, and he made proposals to publish a *History of Discoveries Relating to Vision Light and Colours*. The subscription to this work was not, however, sufficient to induce him to proceed, and after a considerable outlay in the purchase of books and other material the project was abandoned.

Priestley was, perhaps, the most industrious book-

maker of his age. Boswell indeed dubbed him a "literary Jack-of-all-Trades," and he was busy with proof-sheets even to the day of his death. In fact, the closing act of his life, before he put his hand to his face to hide the last flicker of the vital spark, was to make a correction in a proof-sheet. He usually composed in shorthand, and much of this work was done in the family circle, sitting by the parlour fire. Conversation never disturbed him. Although his style is somewhat prolix, his language is simple and direct and his meaning invariably clear. Charges that his writings were hasty performances in nowise disturbed him. Indeed, he was wont to say that some of those that were most hurriedly done were among those that were best received. Whatever might have been the time he spent on their composition he was confident that more would not have contributed to their perfection in any essential particular, and about anything farther he was never very solicitous. His object, he said, was not to acquire the character of a fine writer but of a useful one. Pecuniary gain was never the chief object of his work; several of his books, indeed, were written with the prospect of certain loss. Many writers before and since the great lexicographer have left us what they have imagined to have been the secret of their success as literary craftsmen, and have told us of the means by which they gained their proficiency of composition and mastery of style. Priestley has no pretensions to be considered a master of style; nevertheless, it is of interest to learn how he acquired facility in writing the simple, unaffected English which characterises his literary work. It came, he said, from a practice of committing to writing as much as he could of the sermons he heard, and of com-

posing much in verse. With regard to the sermons, he says :—

“This practice I began very early, and continued it until I was able from the heads of a discourse to supply the rest myself. For, not troubling myself to commit to memory much of the amplification, and writing at home almost as much as I had heard, I insensibly acquired a habit of composing with great readiness, and from this practice I believe I have derived great advantage through life, composition seldom employing so much time as would be necessary to write in long hand anything I have published.”

As regards the verses, he says :—

“I was myself far from having any pretension to the character of a poet, but in the early part of my life I was a great versifier, and this, I believe, as well as my custom of writing after preachers, mentioned before, contributed to the ease with which I always wrote prose.”

If Priestley was not himself a poet, he was at least the cause of poetry in another. Miss Aikin once told him that it was the perusal of some verses of his that first induced her fledgling muse to soar—so that, he adds, “this country is in some measure indebted to me for one of the best poets it can boast of.” No example of Priestley’s abilities as a “versifier” has come down to us, but in that dainty little sketch of the Warrington society, by Miss Lucy Aikin, from which we have already quoted, allusion is made to his accomplishment.

“Both *bouts rimés* and *vers de société* were in fashion with the set. Once it was their custom to slip anonymous pieces into Mrs Priestley’s work-bag. One ‘copy of verses,’ a very eloquent one, puzzled all guessers a long time ; at length it was traced to Dr Priestley’s self.”

To the man of science the special interest of Priestley’s connection with Leeds arises from the fact that he began there that fruitful series of inquiries, relating to what

he called "the doctrine of air," which eventually raised him to the position of one of the greatest chemical discoverers of his time. The house in which he first lived whilst at Leeds was in Meadow Lane and adjoined the public brew house of Jakes and Nell. He was thereby led, in the outset, to amuse himself by making experiments on the "fixed air," or carbonic acid, which is largely produced in the process of fermentation. When he removed to his second house in Basinghall Street, on the site where the schools now stand, he was under the necessity of making the fixed air for himself; and, as he distinctly and faithfully notes in his various publications on the subject, he was led to make one experiment after another until he became, what he does not state, the greatest master of pneumatic chemistry of his age.

When he began these experiments he tells us he knew very little of chemistry. Indeed, he says he had in a manner no idea on the subject before his attention was drawn to it in a course of lectures delivered in the Warrington Academy by Dr Turner of Liverpool. But, as he says, on the whole, this circumstance was no disadvantage to him, as in the situation in which he found himself he was led to devise an apparatus and processes of his own adapted to his peculiar views. If he had been previously accustomed to the usual chemical processes he might not have so easily thought of any other; and without new modes of operation he thinks he should hardly have discovered anything materially new. His means did not permit him to purchase expensive apparatus. Indeed, this very circumstance materially contributed to his success by making his apparatus so simple that his experiments could be readily repeated and their accuracy thereby ensured.

His first contribution to Pneumatic Chemistry was published in 1772. It was a small pamphlet on a method of impregnating water with fixed air, which, being immediately translated into French, excited a great degree of attention to the subject, and this was much increased by the publication of his first experimental paper in the *Philosophical Transactions of the Royal Society*.

Priestley's earliest method of impregnating water with carbonic acid consisted in exposing it to the gas above the surface of fermenting wort. This process was no doubt accompanied with many disadvantages and the resulting solution could not have been very palatable. Later on he adopted the method originally employed by Lane in 1709, although apparently in ignorance of Lane's paper in the *Philosophical Transactions*, of making the gas from chalk and sulphuric acid and leading it directly into the water by means of a flexible tube provided with an intercepting bladder to retain any solid or acid substance projected from the effervescent materials in the generating flask. At about this period increased attention was being paid to the question of the supply of drinking water in the Navy, owing to the publication of Irving's plan of making fresh water from sea-water by distillation, and Priestley conceived the idea that if some ready means could be devised of impregnating water with carbonic acid on shipboard the solution might be useful as a preventive of sea scurvy.

Priestley brought his idea to the knowledge of the Duke of Northumberland, and showed a sample of the impregnated water to Sir George Savile, who introduced him to Lord Sandwich, at that time First Lord of the

Admiralty in Lord North's Administration. The Board of Admiralty thought the matter was of sufficient importance to ask for a report from the College of Physicians, and Priestley was requested to appear before that body in order to explain and illustrate his process. The report from the College was favourable, and in consequence two war-ships were fitted with the apparatus.

The idea that scurvy, in common with other so-called putrid diseases, was due to an insufficient supply of "fixed air" in the animal economy, and that it might be cured by the administration of that gas, originated with Dr Macbride about the middle of the eighteenth century, shortly after Black had established the individuality of the gas, and it was current doctrine with the faculty at the time of Priestley's experiments. The reasons which Macbride gave in support of his hypothesis are contained in his *Essays on Medical and Philosophical Subjects*, and are sufficiently ingenious to be worth stating as characteristic of much of the therapeutics of the time. Macbride assumed that substances held together, and acquired the quality of firmness, by virtue of containing a "cementing principle," which ensured the perfect cohesion of their constituent particles, and that as putrefaction resulted in the decomposition and disintegration of substances, putridity was connected with the loss or disappearance of this cementing or cohering principle. He found that "fixed air" was invariably produced when animal and vegetable substances putrefy, that a greater amount of fixed air is produced from vegetable substances than from animal substances, and that animal and vegetable matters putrefy more rapidly when mixed than when separate, and yield more fixed air in conjunction than apart.

On the basis of these observations Macbride proceeded to explain the well-established fact that a diet mainly composed of animal food is apt to produce sea scurvy, the remedy for which is a sufficient supply of fresh vegetables, by assuming that the virtue of the vegetables was due to the evolution of a greater amount of carbonic acid in the process of digestion, the fixed air so liberated in the body counteracting, by its antiseptic powers, putridity in the circulating fluids.

We are not here concerned with the subsequent history of so-called ærated or soda-water, as it came to be called, but it is worth noting that Priestley's account of his process contains one remark which is not without significance in view of latter-day developments. He says :—

“ I do not doubt but that, by the help of a condensing engine, water might be much more highly impregnated with the virtues of the Pyrmont spring, and it would not be difficult to contrive a method of doing it.”

The manufacture of these waters was subsequently taken up by Priestley's friend and *satellite*, as he called himself, Richard Bewley, of Great Massingham, an apothecary, and the inventor of the well-known “mephitic julep.” Bewley appears to have discovered that the addition of a small quantity of carbonate of soda to the water enabled it to absorb and retain an increased quantity of carbonic acid, and to him, therefore, is due the credit of first making what was long called “acidulous soda-water.” The receipt for its manufacture and use, given by Henry of Manchester, is sufficiently quaint to be worth reproduction :—

“To prepare Mr Bewley's julep dissolve three drachms of fossil alkali in each quart of water, and throw in streams of

fixed air till the alkaline taste be destroyed. This julep should not be prepared in too large quantities, and should be kept in bottles very closely corked and sealed. Four ounces of it may be taken at a time, drinking a draught of lemonade or water acidulated with vinegar or weak spirit of vitriol, by which means the fixed air will be extricated in the stomach."

It is hardly to be supposed that the Royal Society Club in 1773 adopted all the social manners and customs of the period. Nevertheless, its members, who were among the most influential fellows of the Society, were evidently greatly impressed with the merits of Priestley's soda-water, since the Council of the Society were moved to reward its discoverer with the Copley Medal.

In making the award on St Andrew's Day 1773, Sir John Pringle, then President of the Royal Society, said :—

"For having learned from Dr Black that this fixed or mephitic air could in great abundance be procured from chalk by means of diluted spirits of vitriol ; from Dr Macbride that this fluid was of a considerable antiseptic nature ; from Dr Cavendish that it could in a large quantity be absorbed by water ; and from Dr Brownrigg that it was this very air which gave the briskness and chief virtues to the Spa and Pyrmont waters ; Dr Priestley, I say, so well instructed, conceived that common water impregnated with this fluid alone might be useful in medicine, particularly for sailors on long voyages, for curing or preventing the sea scurvy."

To-day the Copley Medal is regarded as the highest award which it is in the power of the Society to bestow, and certainly no man starts his scientific career by acquiring it—not even for so signal an invention as that of soda-water.

Whilst Priestley was at Leeds a proposal was made to him that he should accompany Captain Cook in his second voyage to the South Seas. It probably arose

from his connection with the Admiralty in the matter of his invention. He tells us that as the terms were very advantageous he consented to it, the heads of his congregation agreeing to keep an assistant to supply his place during his absence. But Mr Banks informed him that he was objected to by some clergymen in the Board of Longitude, who had the direction of this business, on account of his religious principles. "Whether," said Huxley, in commenting on this circumstance in the course of his speech at the unveiling of the Priestley statue in Birmingham in 1874, "these worthy ecclesiastics feared that Priestley's presence among the ship's company might expose his Majesty's sloop *Resolution* to the fate which aforetime befell a certain ship that went from Joppa to Tarshish, or whether they were alarmed lest a Socinian should undermine that piety which in the days of Commodore Trunnion so strikingly characterised sailors, does not appear." The appointment was given to Reinhold Forster, a man, as Priestley fully admitted, far better qualified for the position.

CHAPTER VI

Becomes literary companion to Lord Shelburne—Goes abroad—His visit to Paris—His scientific work at Calne and in London—Continues his theological and metaphysical studies—His growing unpopularity—Leaves Lord Shelburne.

PRIESTLEY continued at Leeds for about six years. Although very happy there he was tempted to leave Mill Hill Chapel to enter the service of Lord Shelburne. How he was regarded by his flock may be gleaned from the addresses which were presented to him on the eve of his departure; these, together with his own farewell letter, are still preserved among the Chapel books of Mill Hill. But a stipend of one hundred guineas a year, and a house which was not adequate to contain a family now increased by the birth of two sons, and with no possibility of making any provision for them in the event of his death, induced him to accept Lord Shelburne's proposals.

Lord Shelburne, afterwards first Marquis of Lansdowne, one of the most enlightened of the many politicians who sought to direct the destinies of this kingdom during the stormy times of the last thirty years of the eighteenth century, had been Secretary of State in Pitt's administration of 1766, but had been dismissed from office in 1768 on account of his conciliatory policy towards America, and at this particular time was living in retirement at Bowood. Under these circumstances his lordship, a man of culture and fond of literature, sought the companionship of some kindred spirit. Through the good offices of Dr Price, a mutual

friend, he was led to make Priestley so generous an offer—viz., two and a half times his Leeds salary, a pleasant house at Calne in the summer and a house in town during the winter, and a retiring allowance for life should their connection be dissolved—that our philosopher was constrained to accept a position which, despite its perils and possible constraints, was so alluring. The engagement seems to have given satisfaction also to Priestley's friends, if we may judge from the following extract from one of Wedgwood's letters to his partner at Etruria, Thomas Bentley of Liverpool, one of the founders of the Warrington Academy :—

“ I am glad to hear of Dr Priestley's noble appointment, taking it for granted that he is to go on writing and publishing with the same freedom he now does, otherwise I had much rather he still remained in Yorkshire.” Meteyard, II. 451.

In their political sentiments, and in their views on the great questions which at that time divided parties, the two men had much in common. Lord Shelburne was certainly not unaware of Priestley's political proclivities, and the pamphlet he had written at Franklin's instigation on the American question probably expressed his Lordship's own sentiments. At the same time Priestley was under no obligation to serve Lord Shelburne politically, and there is no evidence that any such service was either expected or rendered. His office was nominally that of librarian, but he had little to do in that capacity beyond arranging and cataloguing the books and numerous manuscripts at Bowood and Lansdowne House and making an index of Lord Shelburne's private papers. Indeed, Lord Shelburne treated him rather as a companion and friend than as a servant, taking him, in the second year of his engage-

ment, on a journey through Flanders, Holland and Germany as far as Strasburg, and spending a month in Paris. The time he spent on the Continent made him sensible of the benefit of foreign travel, even without the advantage of much conversation with foreigners. Indeed, he says the very sight of new countries, buildings and customs of an unfamiliar type, even the very hearing of a fresh language, however unintelligible, stimulates and widens the mind and gives it new ideas. He saw everything to the best advantage and without any anxiety or trouble, and he had an opportunity of meeting and conversing with every person of eminence wherever he went, the political characters by Lord Shelburne's connections and the literary and scientific ones by his own. One of these was Magellan, or Magalhães, a Portuguese Jesuit descended from the great navigator of that name. He resided in England, where he died in, or shortly before, 1790. He had early information on scientific matters from abroad, and was frequently employed in procuring English instruments for foreigners. He was a Fellow of the Royal Society and an active correspondent of Lavoisier's, to whom he sent all scientific memoirs published in England, Priestley's among the number. Magellan was the subject of a notable trial at law—one of the last indeed of its kind in England. He was indicted at the suit of a common informer under the statute against saying Mass, but the suit, which was heard before Lord Mansfield, was dismissed on some point of legal informality.

It was, no doubt, mainly through Magellan that Priestley was brought into the society of that brilliant galaxy of men of science which at that period was the

glory of France. In some respects he was out of sympathy with this environment, and, as he confesses, soon tired of Paris. Priestley never obtruded his religious convictions on any company he might be in; at the same time he never forgot that he was a Christian and a minister of religion. What is now called Agnosticism was at least as prevalent during the latter half of the eighteenth century as at any period of the history of Europe. Priestley tells us that a great part of the company he saw at Lord Shelburne's did not really know what Christianity was, and Lord Shelburne numbered among his friends and political associates almost all who were intellectually eminent at that time in this country. He was not unprepared, therefore, to find that all the philosophers to whom he was introduced at Paris were unbelievers in Christianity and even professed Atheists. He was told, indeed, by some of them that he was the only person they had ever met with, of whose understanding they had any opinion, who professed to believe Christianity. It was this experience which caused Priestley to write his *Letters to a Philosophical Unbeliever*. He says that as he had conversed so much with unbelievers at home and abroad he thought he should be able to combat their prejudices with advantage. Indeed, he was wont to say that the greatest satisfaction he received from the success of his philosophical pursuits arose from the genuine weight it gave to his attempts to defend the principles of Christianity and to free it from those corruptions which prevent its reception with philosophical and thinking persons.

Of the many advantages he enjoyed through his connection with Lord Shelburne, Priestley was always

fully sensible. It came to him at the most opportune period of his career, and in the full tide of his intellectual vigour. The years he spent in this association were, so far at least as science is concerned, the most fruitful of his life. Lord Shelburne was a generous patron, and particularly encouraged Priestley in his chemical inquiries, affording him ample opportunity for their prosecution and defraying much of the expense they occasioned. He had pleasure in witnessing his experiments, and frequently requested him to exhibit them to his guests, particularly to foreigners, by whom a knowledge of Priestley's work was thus spread abroad.

Priestley's energies were, however, not wholly engrossed by his scientific labours. Theology and metaphysics still claimed much of his time, and to this period belongs the concluding portion of his *Institutes of Natural and Revealed Religion* and his *Harmony of the Gospels*, and his *Disquisitions relating to Matter and Spirit*. He also at this time wrote some *Miscellaneous Observations relating to Education*, and published his *Warrington Lectures on Oratory and Criticism*, which he dedicated to his patron's eldest son, Lord Fitzmaurice.

Certain of these publications occasioned considerable uproar at the time of their appearance: the outcry indeed was such, he says, as could hardly have been imagined. He was attacked in almost every newspaper, and in the greater number of the periodicals, as an unbeliever in revelation and no better than an Atheist. In the preface to his *Institutes of Natural and Revealed Religion* he had been led to question the principles of Reid, Beattie and Oswald with respect to their doctrine of *common sense*, which they had made to supersede all

rational inquiry into the subject of religion, and he subsequently developed the attack in a separate publication. He expressed his belief in the doctrine of philosophical necessity and his admiration of Hurdley's theory of the human mind. He had uttered some doubt of the immateriality of the sentient principle in man, and after giving, as he says, the closest attention to the subject, he was firmly persuaded that man is wholly material, and that our only prospect of immortality is from the Christian doctrine of a resurrection.

Priestley clearly recognised that many of these publications were not calculated to improve his relations with Lord Shelburne. Indeed, he says several attempts were made by Lord Shelburne's friends, though none by himself, to dissuade him from persisting in them.

He goes on to say that :—

"In order to proceed with the greatest caution in a business of such moment I desired some of my learned friends, and especially Dr Price, to peruse the work before it was published, and the remarks that he made upon it led to a free and friendly discussion of the several subjects of it, which are afterwards published jointly, and it remains a proof of the possibility of discussing subjects mutually considered as of the greatest importance with the most perfect good-temper and without the least diminution of friendship."

Lord Shelburne's political enemies were not slow to take advantage of the outcry raised against Priestley by the orthodox and to strike at the patron through the philosopher.

It is obvious, from Priestley's letters to his friends at about this period, that he was sensible that his relations with Pitt's Secretary of State had become somewhat strained, and when he received an intimation through Dr Price that Lord Shelburne wished to give him an

✓ establishment in Ireland, where he had large property, he interpreted this as signifying that the Minister desired that their connection should be severed. They parted amicably, Lord Shelburne continuing to pay him the promised annuity of £150 until the end of his days, paying it, too, contrary to the insinuation of his enemies, with perfect punctuality. That there was no unfriendly feeling on the part of Lord Shelburne at a separation which seemed to be dictated solely by considerations of political exigency would appear from the circumstance that a few years later he sent a common friend to Priestley, who was then settled in Birmingham, to invite him to resume his old position, accompanying his request with expressions which left no doubt of the value he set upon the companionship. Sensible as Priestley was of Lord Shelburne's feelings towards him, he was in no mind to return to a situation which experience had shown might be incompatible with independence.

CHAPTER VII

Removes to London—Declines a pension—Renews his acquaintance with Franklin—Goes to Birmingham—Becomes a member of the Lunar Society.

ON leaving Calne, Priestley repaired to London. His position was somewhat precarious, as he had practically nothing but his allowance from Lord Shelburne to support him. This, although larger than the stipend he had enjoyed at Leeds, was barely sufficient for his growing family. Friends however were not wanting to come to his assistance. Indeed, during his residence at Calne, some of them observing, as they said, that many of his experiments had not been carried to their proper extent on account of the expense that would have attended them, proposed to supply him with whatever sums he should want for that purpose and named a hundred pounds per annum.

“This large subscription I declined,” he says, “lest the discovery of it (by the use that I should, of course, make of it) should give umbrage to Lord Shelburne; but I consented to accept forty pounds per annum, which from that time he (Dr Fothergill) regularly paid me from the contribution of himself, Sir Theodore Jansen, Mr Constable and Sir George Savile.”

This sentence is characteristic of Priestley and of much of his autobiography. Probably no man with so many enemies had such troops of friends, and certainly none had so many and such generous benefactors. And the measure of their beneficence was only equalled by that of Priestley's gratitude and sense of obligation. Indeed, he says the chief object he had in putting together his

memoirs was that he thought it right to leave behind him some account of his friends and benefactors, and accordingly we find that the incidents in his career are dwelt upon by him rather with the idea of illustrating his indebtedness to others than as records of his own achievements.

On his removal to London, where he contemplated resuming his profession as a teacher, Dr Fothergill and his co-subscribers considerably increased his allowance for experiments, whilst at the same time other friends were not less zealous that he should have the means to pursue his theological studies and to publish the fruits of his labours.

Indeed, all who could in any way assist seemed to vie with one another in help. Parker, the optician of Fleet Street, supplied him with every instrument that he wanted in glass, and Wedgwood, the potter, sent him innumerable retorts, tubes and other articles of clay. Without such assistance he could not have carried on his experiments, except on a very small scale and under great disadvantages.

During Lord Rockingham's administration, and subsequently at the beginning of that of Mr Pitt, some suggestions were made to provide Priestley with a pension to assist in defraying the expense of his inquiries.¹

He however declined all overtures of this kind, wishing, as he said, to preserve himself independent of everything connected with the court, and preferring the

¹ He had in John Lee, a native of Leeds and a man of about his own age, who became Solicitor-General in 1782, a friend who offered to further his interests in that matter. Priestley, in his autobiography, says: "Mr Lee showed himself particularly my friend at the time I left Lord Shelburne, assisting me in the difficulties with which I was then pressed, and continuing to befriend me afterwards by seasonable benefactions."

assistance of individuals who were lovers of liberty as well as of science.

His winter's residence in London threw him constantly into the society of his old friend Franklin; indeed, he says, as members of the same club few days passed without their seeing one another, and their friendship ripened into the closest intimacy.

There can be no doubt that this intercourse with Franklin not only led Priestley to the study of natural science, but quickened and fostered his love of civil and political liberty. Priestley in his autobiography does ample justice to Franklin's efforts to maintain the union of the American Colonies with this country.

"But Franklin," says Mr Choate (Inaugural address as President of the Birmingham and Midland Institute, October 23, 1903), "was more than a staunch Loyalist. He was an Imperialist in the most stalwart sense of the word, and on a very broad gauge."

His biographer, Parton, truly says:—

"It was one of Franklin's most cherished opinions that the greatness of England and the happiness of America depended chiefly upon their being cordially united. The 'country' which Franklin loved was not England nor America, but the great and glorious Empire which these two united to form."

In writing to Lord Kames, he said:—

"I have long been of opinion that the foundations of the future grandeur and stability of the British Empire lie in America; and though, like other foundations, they are low and little now, they are nevertheless broad and strong enough to support the greatest political structure that human wisdom ever yet erected."

In 1774 he wrote:—

"It has long appeared to me that the only true British policy was that which aimed at the good of the whole British Empire,

not that which sought the advantage of one part in the disadvantage of the others ; therefore all measures of procuring gain to the Mother Country arising from loss to her colonies, and all gain to the Colonies arising from or occasioning loss to Britain, especially where the gain was small and the loss was great. . . . I in my own mind condemned as improper, partial, unjust and mischievous, tending to create dissensions and weaken that union on which the strength, solidity and duration of the Empire greatly depended ; and I opposed, as far as my little powers went, all proceedings, either here or in America, that in my opinion had such tendency.”

Priestley's testimony is no less explicit. He says :—

“The unity of the British Empire in all its parts was a favourite idea of his. He used to compare it to a beautiful china vase which, if ever broken, could never be put together again, and so great an admirer was he of the British constitution that he said he saw no inconvenience from its being extended over a great part of the globe.”

In the autobiography we further read :—

“I can bear witness that he (Franklin) was so far from promoting, as was generally supposed, that he took every method in his power to prevent a rupture between the two countries. He urged so much the doctrine of forbearance, that for some time he was unpopular with the Americans on that account, as too much a friend to Great Britain. His advice to them was to bear everything for the present, as they were sure in time to outgrow all their grievances, as it could not be in the power of the Mother Country to oppress them long.

“He dreaded the war, and often said that if the difference should come to an open rupture it would be a war of *ten years*, and he should not live to see the end of it. In reality the war lasted nearly eight years, but he did not live to see the happy termination of it. That the issue would be favourable to America he never doubted. The English, he used to say, may take all our great towns, but that will not give them possession of the country. The last day that he spent in England, having given out that he should leave London the day before, we passed together without any other company ; and much of the time was employed in reading American

newspapers, especially accounts of the reception which the ‘Boston Port Bill’ met with in America; and as he read the addresses to the inhabitants of Boston from the places in the neighbourhood the tears trickled down his cheeks.”

What Franklin thought of Priestley may be gathered from the following extract from one of his letters to Vaughan, one of Priestley’s Warrington pupils, written in October 1788 after his return to America:—

“Remember me affectionately to the good Dr Price and to the honest heretic, Dr Priestley. I do not call him honest by way of distinction, for I think all the heretics I have known have been virtuous men. They have the virtue of fortitude, or they would not venture to own their heresy; and they cannot afford to be deficient in any of the other virtues, as that would give advantage to their many enemies; and they have not, like orthodox sinners, such a number of friends to excuse or justify them. Do not, however, mistake me. It is not to my good friend’s heresy that I impute his honesty. On the contrary ’tis his honesty that has brought upon him the character of heretic.”

In 1780, at the suggestion of his brother-in-law, John Wilkinson, one of his truest friends, Priestley was led to take up his residence in Birmingham. There were many circumstances which made this step desirable. In Birmingham he had friends prepared to welcome him and society in every way sympathetic and congenial. Moreover, he was desirous of resuming his ministerial duties, which had been intermitted for the past six or seven years, and an opportunity of doing so, with a congregation not less liberal than he had served at Leeds, offered itself, owing to the approaching retirement of Mr Hawkes from the charge of the New Meeting. As regards his philosophical pursuits he had the convenience of good workmen of every kind and he could count upon the practical sympathy and interest of men like Watt, his partner Boulton, Keir, Withering, Wedg-

wood, Erasmus Darwin, and the Galtons, all at that time living in Birmingham or in its vicinity. These men and their friends constituted indeed a cultured society without a parallel in any other town in the kingdom, except possibly in the Metropolis. The more eminent of them formed themselves into an association, to which frequent reference is made in the biographical literature of the period, on account of the part which it played in the social and intellectual life of the Midlands.

The Lunar Society of Birmingham appears to have been formed about the year 1766 by Matthew Boulton and Erasmus Darwin, at that time resident in Birmingham. The members were about ten or a dozen in number and met at each other's houses for dinner once a month on the Monday nearest to the full moon, in order to have the benefit of its light in returning home. They were in the habit of sitting down to dinner at two o'clock and their meeting lasted until eight.

Each member was allowed to bring a friend, and thus it happened that many distinguished men were recipients, at various times, of the Club's hospitality. Among them we find Wedgwood, Sir Joseph Banks, Sir William Herschel, Smeaton, the builder of the Eddystone Lighthouse; Dr Samuel Parr, the critic; Afzelius, the teacher of Berzelius; Solander, the well-known naturalist and traveller; De Luc and other names eminent in the literary and scientific annals of the century.

As might be supposed from what we know of its founders and their friends the constitution of the society was on the broadest possible basis. "We had nothing to do," says Priestley, "with the *religious* or political principles of each other; we were united by a common

love of *science*, which we thought sufficient to bring together persons of all distinctions—Christians, Jews, Mahometans and heathens, Monarchists and Republicans.”

The invitations issued by the host were usually accompanied by some intimation of the nature of the impending symposium. Thus Watt writes to Darwin, under date Jan. 3, 1781 :—

“I beg that you would impress on your memory the idea that you promised to dine with sundry men of learning at my house on Monday next, and that you will realise the idea. For your encouragement there is a new book to be cut up, and it is to be determined whether or not heat is a compound of phlogiston and empyreal air, and whether a mirror can reflect the heat of the fire. I give you a friendly warning that you may be found wanting whichever opinion you adopt in the latter question, therefore be cautious. If you are meek and humble, perhaps you may be told what light is made of, and also how to make it, and the theory proved both by synthesis and analysis.”

The discussions of the philosophic *convives* were not, however, confined exclusively to chemistry.

“The period,” says Mr Carrington Bolton, “was one of great activity in the world of science; Laplace was applying his mathematical genius to the problems of astronomy; Herschel was sweeping the heavens with his gigantic telescopes; Galvani and Volta were laying the foundations of a revolution in electricity; Count Rumford in Bavaria was devoting his great energy to industrial and social economy; Hatton and Werner were geologising in their respective countries; Haüy was systematising the innumerable crystalline forms occurring in nature; the Montgolfier brothers were experimenting with air-balloons and prophesying the yet unsolved problem of aërial navigation; Captain James Cook returned from his memorable voyages around the world, full of adventures and novelties in nature: the application of steam to the driving of land carriages and the propelling of boats was gradually being perfected by patience and genius. These, together with the metaphysical and even

the political questions of the day, must have engrossed the attention of the talented friends who dined together at the full moon."

A picturesque account of the Club is given in Mrs Schimmelpenninck's *Memoirs*. Mary Ann Schimmelpenninck (*née* Galton) was the daughter of Mr Samuel Galton, a wealthy patron of letters and a man of considerable intellectual ability. He was interested in scientific pursuits and was a fellow of the Royal Society. His house at Barr, about seven or eight miles from Birmingham, was a notable place in the social life of the district, and the Lunar Society held some of its most delightful meetings under his hospitable roof, as Mrs Schimmelpenninck recalls. She thus writes of Dr Priestley :—

"A man of admirable simplicity, gentleness and kindness of heart, united with great acuteness of intellect. I can never forget the impression produced on me by the serene expression of his countenance."

In his *Memoirs* Richard Lovell Edgeworth says of the Society that it consisted of—

"Men of very different characters, but all devoted to literature and science. This mutual intimacy has never been broken but by death, nor have any of the number failed to distinguish themselves in science or literature. Some may think I ought, with due modesty, to except myself. Mr Keir, with his knowledge of the world and good sense; Dr Small, with his benevolence and profound sagacity; . . . Boulton, with his mobility, quick perception and bold adventure; Watt, with his strong inventive faculty, undeviating steadiness and bold resources; Darwin, with his imagination, science and poetical excellence; and Day, with his unwearied research after truth, his integrity and eloquence, proved altogether such a society as few men have had the good fortune to live with; such an assemblage of friends as fewer still have had the happiness to possess and keep through life."

There can be no doubt that Priestley's coming to Birmingham contributed greatly to the interest of the meetings of the Lunar Society and reacted beneficially on Priestley himself by stimulating his activity and affording him the sympathy of congenial minds not less interested than he was in the study of natural science. As each meeting came round he was certain to find a gathering curious to hear of his latest experiments and eager to discuss with him their bearing upon the chemical doctrine of the period.

Priestley's influence and position in the Society may be inferred from the circumstance that almost immediately after he joined it Pneumatic Chemistry became one of the chief topics of discussion. This is amply demonstrated in the correspondence of its various members, which has been preserved to us in the biographies of Watt, Wedgwood and others, and in the scientific letters of Priestley, which have been collected and edited by Mr H. Carrington Bolton. One direct outcome of this interest is seen in Watt's connection with the History of the Discovery of the Composition of Water. It is reasonably certain that if Watt and Priestley had not foregathered round the festive board of the Lunar Society, Watt would not have been stimulated to theorise on the meaning and true significance of Priestley's experiments, and as to their bearing upon the fact that Priestley's dephlogisticated air (oxygen) and inflammable air (hydrogen) enter into the composition of water. Watt's claim to be considered as the discoverer of the composition of water rests upon his interpretation of the experimental phenomena made known to him by Priestley shortly after his arrival in Birmingham. The Water Controversy—a controversy which keenly

excited the entire scientific world a generation or so ago—may be said to have arisen from the accident of Priestley's removal to Birmingham and to his association with the Lunar Society.

Priestley's connection with the Society influenced the progress of chemistry in this country both directly and indirectly. As already stated, he himself was greatly stimulated to accumulate chemical facts by his association with men like Boulton, Watt, Wedgwood, Keir, Darwin, who loved knowledge for its own sake, but who were at the same time quite alive to the material benefits which they and their fellow-men might derive from the pursuit of scientific inquiry. The measure of their interest may be gauged by the extent of their support, and by the readiness with which they furnished Priestley with the means to carry on his investigations. Priestley not only freely communicated to them the results of his labours, but he incidentally fixed their attention on a class of phenomena which, more than any other, were calculated to afford an insight into the real nature of chemical change, and to lead to a rational explanation of chemical phenomena.

Priestley was not consciously a casuist, but there can be no question that the interpretation which his active and ingenious mind occasionally led him to place upon his work not only served to blind himself, but was the means of obscuring the truth for a time from others. We have only to read the correspondence, already more than once alluded to, to find ample proof that such was the case. In a letter to Wedgwood, of March 30, 1781, Boulton writes :—

“ We have long talked of phlogiston without knowing what we talked about ; but now that Dr Priestley hath brought the

matter to light we can pour that element out of one vessel into another ; can tell how much of it by accurate measurement is necessary to reduce a calx to a metal, which is easily done, and without putting that calx into contact with any visible thing. In short, this goddess of levity can be measured and weighed like other matter. For the rest, I refer you to the doctor himself."

In the following year (March 21, 1782) we find Priestley also writing to Wedgwood :—

"Before my late experiments, phlogiston was indeed almost given up by the Lunar Society, but now it seems to be re-established."

How difficult it was to convince Priestley may be seen from the following extract from a letter to his friend Franklin, who was then in Paris, written at about the same time :—

"BIRMINGHAM, June 24, 1782.

"Please to inform the Duc de Rochefoucauld, whose civilities to me I remember with pleasure, that my experiments are certainly inconsistent with Mr Lavoisier's supposition of there being no such thing as phlogiston, and that it is the addition of air, and not the loss of anything, that converts a metal into a calx. In their usual state calces of metals do not contain air, but that may be expelled by heat, and after this I reduce them to a perfect metallic state by nothing but inflammable air, which they imbibe *in toto*, without any decomposition. I lately reduced 101 ounce measures of this air to two by calx of lead, and that small remainder was still inflammable. I explain Mr Lavoisier's experiments by supposing that *precipitate per se* [mercuric oxide] contains all the phlogiston of the metal mercury, but in a different state ; but I can show other calces which also contain more phlogiston than the metals themselves. That mercury in its metallic state does contain phlogiston or inflammable air is evident from the production of nitrous air by the solution of it in spirits of nitre, and I make *nitrous air* from nothing but *nitrous vapour* and inflammable air ; so that it indisputably consists of these two ingredients. I have already ascertained

the proportion of inflammable air that enters into the composition of lead, tin, copper and silver, and am proceeding with the other metals as fast as I can. When the whole is completed I shall give you a further account of it.

"I am exceedingly concerned to find that it is so difficult a thing to make *peace*; but I hope before the campaign is over all parties will have had enough of *war*, and be sensible that they will gain nothing by continuing it. If I had any voice in the business, the prospect of seeing you in this country would be a strong additional motive to accelerate the negotiations.

"With the greatest respect and every good wish.—I am,
 dear sir, yours sincerely,
 J. PRIESTLEY."

There were already many indications prior to 1780 that men were beginning to be troubled as to the sufficiency of Stahl's generalisation to account for the rapidly-accumulating mass of facts which the application of quantitative chemistry to the study of natural phenomena was bringing to light. Priestley's advent in Birmingham certainly retarded by the weight of his authority the growth in heterodoxy in that particular among the members of the Lunar Society, and indirectly therefore all whom they could influence.

The following letter from Keir is typical of many which passed between the members of the Society in reference to Priestley's work and of the discussions which it occasioned.

KEIR TO PRIESTLEY.

"The more we discover of Nature, the further we are removed from the conceit of our being able to understand the operations.

"I wish M. Berthollet and his associates would relate their facts in plain prose, that all men might understand them, and reserve their poetry of the new nomenclature for their theoretical commentaries on the facts.

"I have wished much to call on you to hear of the progress of your experiments, but have been much indisposed with the

rheumatism. I long to know what acids you get with the other inflammable airs. If you get different acids from the inflammable air made from sulphur and water, that made from marine acid and copper (for I would avoid iron on account of its plumbago and carbon), and that made from charcoal and water :—I say, if these acids are different (suppose, according to my notions, vitriolic, marine and fixed air), then will you not be obliged to admit that there is not one inflammable but many inflammables, which opinion you now think as heterodox as the Athanasian System.

“However, there are wonderful resources in the dispute about Phlogiston, by which either party can evade, so that I am less sanguine than you are in my hopes of seeing it terminated. One consolation remains, that in your experiments you cannot fail of discovering something perhaps of as great or greater importance for us to know.”

Nevertheless, even in the Club itself there was at least one man who came under the influence of Priestley, but who eventually emancipated himself, and this was Withering, who, we are informed, read to them “a humorous piece in verse entitled ‘The Life and Death of Phlogiston,’ which was long remembered for its clever treatment and pointed wit.”

That Priestley’s influence still reigned in the Club, even down to 1803, may be inferred from the introduction to his essay, “The Doctrine of Phlogiston Established”—the last of his scientific papers—in which he says, “And now that Dr Crawford is dead, I hardly know of any person, except my friends of the Lunar Society of Birmingham, who adhere to the doctrine of Phlogiston.”

As regards the history of the Lunar Society there is little more to tell. One by one its members submitted themselves to the arrest of the “fell sergeant,” and eventually Keir, Watt, and Boulton, the founder, were

the only survivors, and its meetings were gradually discontinued.

“But,” says its historian, “the influence exerted by the Society did not die; it had stimulated inquiry and quickened the zeal for knowledge of all who had come within its influence, and this spirit diffused and propagated itself in all directions.”

Leonard Horner, who visited Soho in 1809, thus refers to the continued moral influence of the association:—

“The remnant of the Lunar Society,” he says, “and the fresh remembrance in others of the remarkable men who composed it, are very interesting. The impression which they made is not yet worn out, but shows itself to the second and third generation, in a spirit of scientific curiosity and free inquiry, which even yet makes some stand against Toryism and the love of gain.”

CHAPTER VIII

Priestley at Birmingham—His theological work there—
His love of literature—His catholicity—His personal
characteristics.

IN 1784 Priestley brought out a revised edition of the work on which his fame as a man of science mainly rests, under the title of "*Experiments and Observations on Different Kinds of Air* ; and other branches of Natural Philosophy connected with the Subject. In three volumes, being the former six abridged and methodised. With many Additions. London, 1790. 3 vols. 8vo."

In a letter to his friend Keir we find an allusion to this matter. He says :—

"I am working like a horse at the new arrangements of my 6 vols. of *Experiments*. It is a tedious business.

"What do you think of an attempt to dedicate this work to the Prince of Wales ? The King I shall never think of in any such light, nor the Prince, unless it be possible that he will be a real patron of science and could look upon it in some other light than that of an honour to myself."

An interesting account of Priestley at this period of his life is to be found in the Memoirs of the French geologist, Faujar St Fond, who visited Birmingham some time after Priestley's settlement there. He says :—

"Dr Priestley received me with the greatest kindness. He presented me to his wife and his daughter, who were distinguished by vivacity, intelligence and gentleness of manner. The young lady spoke to me of one of her brothers, who was then finishing his education at Geneva and to whom she seemed very much attached.

"The building in which Dr Priestley made his chemical and philosophical experiments was detached from his house to avoid

the danger of fire. It consisted of several apartments on a ground floor. Upon entering it we were struck with a simple and ingenious apparatus for making experiments on inflammable gas extracted from iron and water reduced to vapour. The tube, which was thick and long, was made of red copper and cast in one piece to avoid joinings. The part exposed to the fire was thicker than the rest. Into this tube he introduced cuttings or filings of iron, and instead of dropping in the water he preferred making it enter in vapour. The furnace destined for this operation was supplied with coke made of coal, which is the best of all combustibles for the intensity and equality of its heat. By these means he obtained a considerable quantity of inflammable gas of great lightness and without any smell. He observed to me, that by increasing the apparatus and using iron or copper tubes of a large calibre, aerostatic balloons might be filled with far less trouble and expense than by vitriolic acid. Dr Priestley allowed me to take a drawing of this new apparatus for the purpose of communicating it to the French chemists who are engaged in the same pursuit. . . .

“Dr Priestley did not regard the experiments made relative to the decomposition of water as satisfactory. He could not admit the fact to be demonstrated so long as the gas was only obtained through the medium of iron, a metal which is itself susceptible of inflammability; but he waited with impatience for the result of the experiments of the French chemists, particularly those of Lavoisier, who had invented and caused to be constructed an extensive apparatus for the same object.

“‘The decomposition of water,’ said this indefatigable philosopher, addressing himself to me, ‘is of so much importance in Natural Philosophy, and would occupy so distinguished a place among the phenomena of the universe, that far from admitting the fact upon slight evidence, and as it were from enthusiasm, it were rather to be wished that all objections that may be made, and which will still long continue to be made against this theory were completely refuted; in the conflict of opinions, truth may at last be obtained. But I have still so many doubts upon this subject, and I have so many experiments to make, both *pro* and *con*, that I can as yet regard the greatest as only started.’

“Dr Priestley has embellished his solitude with a philosophical

cabinet, which contains all the instruments necessary for his experiments, and a library rendered valuable by a choice of excellent works. The learned possessor employs himself in a variety of studies: History, Moral Philosophy and Religion have all in their turn engaged his pen. An active, intelligent mind and a natural avidity for knowledge gave him a passion for experimental philosophy; but the sensibility and gentleness of his disposition have sometimes directed his attention to pious and philanthropic studies, which do honour to the goodness of his heart, since they always have for their object the happiness of mankind."

Priestley's time in Birmingham was not, however, wholly devoted to science and the social joys of the Lunar Society. Much of it was given to his beloved theology and to editing the *Theological Repository*, which he revived some time after he had settled there. A few months after his arrival he was invited to take charge of the congregation of the New Meeting. With the consent of the congregation his services were mainly confined to Sunday duty and to catechising and lecturing.

Of his preaching Miss Hutton has left us an account. She says:—

"I look upon his character as a preacher to be as amicable as his character as a philosopher is great. In the pulpit he is mild, persuasive and unaffected, and his sermons are full of sound reasoning and good sense. He is not what is called an orator; he uses no actions, no declamation; but his voice and manner are those of one friend speaking to another."

His congregation is described as the most liberal in England, and with many of its members, particularly Mr Russell, he was on the most intimate and affectionate terms. During this period he completed his friendly controversy with the Bishop of Waterford on the duration of Christ's ministry, and he published a

volume of sermons. To the same period belongs his *History of the Corruptions of Christianity*, which he composed and published shortly after his settlement at Birmingham. This work, which he spoke of as the most valuable of all his writings, he dedicated to his "dear friend," Theophilus Lindsey, in the hope that their names may ever be connected as closely after death as they were connected by friendship during life. To Lindsey's example of a pure love of truth, and of the most fearless integrity in asserting it, as evidenced by the sacrifices he had made to it, Priestley says that he owed much of his own wishes "to imbibe the same spirit."

The work, as originally planned, was to be the concluding part of his *Institutes of Natural and Revealed Religion*, but as the matter of it grew it became extended into a separate treatise, larger, indeed, than the whole of the *Institutes*. Its object was to show that modern Christianity was a departure from the original scheme, and that the innovations have debased its spirit and almost annihilated all the happy effects which it was eminently calculated to produce. Although it had begun to recover itself from its corrupted state, and the Reformation was advancing apace, abuses still continued in many places, even although their virulence was very generally abated and the number was greatly increased of those who were most zealous in the profession of Christianity, whose lives were the greatest ornament to it, and who hold it in such purity that if it was fairly exhibited and universally understood it could hardly fail to recommend itself to the acceptance of the whole world.

"But so long as all the Christianity that is known to

Heathens, Mahometans and Jews is of a corrupted and debased kind, and particularly while the profession of it is so much connected with *worldly interest*, it is no wonder that mankind in general refuse to admit it, and that they can even hardly be prevailed upon to give any attention to the evidence that is alleged in its favour. Whereas, when the system itself shall appear to be less liable to objection, it is to be hoped that they may be brought to give proper attention to it, and to the evidence on which it rests."

In this work Priestley attempted to trace every "corruption"—that is every innovation or departure from what he conceives to be the original scheme—to its proper source and "to show what circumstances in the state of things, and especially of other prevailing opinions and prejudices, made the alteration, in doctrine or practice, sufficiently natural, and the introduction and establishment of it easy." Priestley hoped as a true rationalist that this historical method would be found to be one of the most satisfactory modes of argumentation, in order to prove that what he objected to was no part of the original scheme.

"For after the clearest refutation of any particular doctrine that has been long established in Christian churches it will still be asked, how, if it be no part of the scheme, it ever came to be thought so, and to be so generally acquiesced in; and in many cases the mind will not be perfectly satisfied till such questions be answered."

We are mainly concerned with this remarkable work as illustrating the character and attributes of its author, and it is not within our province to give any analysis of its contents. It must be remembered in connection with it that Priestley was no longer an Arian; he was not even a Socinian, as that term was understood by the immediate followers of Faustus Socinus, who thought it

their duty as Christians, and, indeed, essential to Christianity, to pray to Jesus Christ, notwithstanding they believed him to be, in Priestley's phrase, a mere man. Priestley was at this time what he remained until his death—a strict Humanitarian, although he believed in the supernatural power and divine mission of Christ.

Of the reception which awaited his book he could not be altogether unprepared. It was received by the orthodox with a storm of disapproval, and a dozen pens were immediately set to work to demolish its doctrine and to defend the principles he so boldly assailed. Among those who entered the lists the most formidable was Dr Horsley, then Archdeacon of St Albans, whose *Animadversions* were described as “at once nervous, animated and evangelical, but in some passages too sarcastic.”

It says something for Priestley's position and influence in the theological world that his book should have met with the sternest disapprobation in Lutheran, and especially Calvinistic, circles abroad. It was ordered to be burnt by the hands of the common hangman at Dordrecht, in 1785—a sign that the spirit of the Synod of Dort had survived even two centuries.

Priestley thereupon undertook to collect from the original writers the state of opinion on the subject in the age succeeding that of the apostles, and he published the results of his investigation in his “*History of Early Opinion concerning Jesus Christ.*” In four volumes. 8vo.”

This bringing him still more antagonists he retaliated by writing a pamphlet annually in defence of the Unitarian doctrine, until it appeared to himself and his friends that his antagonists produced nothing to which it was of any

consequence to reply. The pains that he took to ascertain the state of early opinions concerning Jesus Christ, and the great misapprehensions that he says he perceived in all the ecclesiastical historians, led him to undertake a *General History of the Christian Church to the Fall of the Western Empire*.

“If you ask me,” says the Rev. Alexander Gordon, “what I should reckon Priestley’s greatest service to theological science, I should say that it is to be found in his adoption of the historical method of investigating the problems of doctrine and in his special handling of that method. The faith of Priestley was the precursor of the modern theme of theological development, though I do not think he used the term. His term was ‘corruption,’ a term which, it may be said, begs a very important question. At anyrate it throws into strong relief the fact, on which all are agreed, that there is, and must be, some primitive nucleus whence developments proceed. Now it is the object of all who, for any reason, are interested in the origin of Christianity to reach this primitive nucleus at its first, undeveloped and uncorrupted stage. Where are we to seek it? By universal consent we must go to the New Testament. There, if anywhere, we shall come upon its traces. Here the agreement begins and ends. The New Testament is in all hands. But one man finds the Trinity in it; another the simplest Monotheism; a third, the papacy; a fourth, the supremacy of the illuminating spirit. The same words yield opposite results, because the principles of interpretation differ. The New Testament is to be interpreted by the voice of the Church; or by the testimony of the Creeds; or by the opinions of the Fathers of the first centuries before the age of dogmatic creeds began at Nicæa. These had been the expedients proposed by the Catholic, the Anglican, the Arian respectively. Socinus had rejected them all. It cannot matter to me (so, in effect, he contended) what any Church, or any Creed, or any Father may have said; I go to the New Testament myself, to read it with my own eyes, to understand it with my own mind.

“This was not the position of Priestley. He thought this as

irrational a proceeding as any of those which it superseded. Even if, by good luck, the true sense were reached, there was no means of proving it to be such. The New Testament, in Priestley's view, is not to be construed as a book of enigmas which might belong to any age. It is not dropped straight out of heaven into the hands of the man of to-day for him to make what he will of it. It belongs to a specific period; it was written for a given class of persons; it was written to be understood. 'Therefore,' said Priestley, 'it will be an unanswerable argument *a priori* against any particular doctrine being contained in the Scriptures, that it was never understood to be so by those persons for whose immediate use the Scriptures were written, and who must have been much better qualified to understand them, in that respect at least, than we can pretend to be at the present day.' (*Works*, vi. 7.)

"Accordingly it is the whole object of Priestley's histories of doctrine to get at the mind of the common Christian people in the first age; to make their primary understanding of Scripture the norm for its true interpretation; and then to trace the process by which this first impression, this real meaning, suffered transmutation by the speculative genius of philosophising divines. Of the Nicene Council he quaintly says, 'there was no House of Commons in that assembly.' It 'represented the Christian Church in no other sense than the House of Lords might be said to represent the English nation.' He conceived that he could penetrate to this unsophisticated sense of the primitive believers through the very writings of the Fathers whereby it had been overlaid and obscured. Their admissions, their rebukes, their appeals, their laboured arguments, their surviving conservatisms: all were materials to his purpose.

"The plan was novel, the conception original, the whole endeavour strictly scientific in its method and basis. And I do not think that Priestley's work in this department has received the full recognition which it rightly claims from us, whether we regard its spirit or its execution. The progress of biblical knowledge implies, no doubt, a readjustment of his argument and a revision of his conclusions. But the readjustment and revision are effected by the use of principles which he was the first to set forth and apply. We now go behind the New Testament just as he went behind the

Fathers. The New Testament itself is, to us, largely a record by help of which we may reach the first impression made by the life, and work, and word of Christ. In so doing we do but carry out his suggestions and carry on his method. He is the genuine precursor of the properly historic treatment of biblical and theological questions."

Priestley's action with respect to the Sunday school movement was another rock of offence to the Established clergy. This movement began in Birmingham in 1784, and was supported by all denominations. The High Church party, however, insisted that all children, irrespective of the religious persuasion of their parents, should attend the worship of the Established Church and no other. After some time, and mainly at the instigation of Priestley, the Dissenters opened their separate Sunday schools, the Old Meeting in 1787, and the New Meeting in 1788, and Priestley preached the first sermon on behalf of the New Meeting Schools in November 1789, and with his son Joseph took an active share in the teaching.

Priestley was a sincere lover of literature, and no man was more sensible of its value to the moral and intellectual life of communities. In his own case he had derived so much benefit from a ready access to books which were beyond his means to purchase that he was ever willing to lend himself to any well-considered attempt to open the storehouses of literature, in its widest sense, as freely as possible, and to do all in his power to foster the love of reading and the spirit of inquiry among all classes of persons. In each succeeding situation—Needham, Nantwich, Warrington, Leeds—he left evidences of his efforts to make books as accessible as possible to the community of which he was

for the time a member. Leeds still enjoys a striking example of these efforts in its proprietary library, and much of its reputation and character is owing to the wise and enlightened spirit which he infused into its administration.

As to the library at Birmingham, he eventually succeeded in giving to it, as Hutton says, "that stability and method without which no institution can prosper." We are further told that "the Society are under many and great obligations to the learned Doctor; it was him who altered its original plan and put it on a more extensive scale; he amended and enlarged the laws and has paid a great attention to its welfare and growing interests."

Priestley's action, and more especially the catholicity he displayed in the selection and admission of such books as in his judgment tended to the spread of rationalism, whether in religion or in politics, drew down upon him the wrath of the Court party, and more particularly of the beneficed clergy of the town and district, and the library was vigorously denounced as "a fountain of erroneous opinions, spreading infidelity, heresy and schism through the whole neighbourhood."

This catholicity is reflected in almost every circumstance of his daily life.

"If liberality of sentiment," he wrote on one occasion, "be the result of general and various acquaintance, few men now living have had a better opportunity of acquiring it than myself. This has arisen from the great variety of my pursuits, which has naturally brought me acquainted with persons of all principles and characters. One day, I remember, I dined in company with an eminent popish priest; the evening I spent with philosophers, determined unbelievers; the next morning I breakfasted, at his own request, with a most zealously orthodox

clergyman, Mr Toplady, and the rest of that day I spent with Dr Jebb, Mr Lindsey and some others, men in all respects after my own heart. I have since enriched my acquaintance with that of some very intelligent Jews; and my opponents, who consider me already as half a Mahometan, will not suppose that I can have any objection to the society of persons of that religion."

Dr Samuel Parr, the Prebend of St Paul's, a staunch friend and true admirer of Priestley, who wrote the inscription on the tablet to his memory in the New Meeting House at Birmingham, related the following characteristic anecdote to Mrs Robert A. Wainwright, who died in 1891, in her 84th year:—

"Now remember this. I knew your grandfather, Dr Priestley. He once invited me to dinner at Fair Hill, and I never was at a more agreeable party in my life. Your grandfather was at the head of the table. I sat at the bottom. At your grandfather's right hand was Mr Berington, the Roman Catholic, and Mr Galton, the Quaker, on his left. Next to me was Robert Robinson, the Baptist, and Mr Proud, minister of the New Jerusalem Church."

All the five guests were remarkable men and distinguished in their several Churches. Dr Parr, one of the most erudite scholars of his time and an acute critic, an inveterate Whig, and a political ally of Fox, Burke and North, was Vicar of Wadenhoe in Northamptonshire, although he resided, as assistant curate, at Hatton, near Warwick, where he had an excellent library. Berington wrote a *Literary History of the Middle Ages*, and the *History of Abelard and Heloise*. Robert Robinson, of Cambridge, was the author of the *History of Baptism*, *Ecclesiastical Researches*, *Village Sermons* and other books. The Swedenborgian minister was the chief defender of the New Jerusalem Church

in England, and was engaged in controversy with Priestley.

A contemporary account of Priestley at this period of his life describes him as about the middle stature, or five feet eight inches high; slender and well proportioned; of fair complexion, eyes grey and sparkling with intelligence, and his whole countenance expressive of the benignity of his heart. He often smiled, but seldom laughed. He was extremely active and agile in his motions; he walked fast and very erect, and his deportment was dignified. His usual dress was a black coat without a cape, a fine linen or cambric stock, a cocked hat, a powdered wig, shoes and buckles. He commonly walked with a long cane in his right hand, and was an excellent pedestrian. "The whole of his dress was remarkably clean, and this purity of person and simple dignity of manners evinced that philosophic propriety which prevailed throughout his conduct as a private individual."

He rose about six o'clock and commonly retired to his study, where he continued until eight, when he met his family at breakfast. He breakfasted on tea, and after breakfast again went to his study, accompanied by his amanuensis. He often devoted the whole of his morning to composition, or divided his morning between the study and the laboratory. When engaged in experimental work he commonly wore a white apron and canvas covers drawn over his sleeves. He dined at one o'clock and was very abstemious. He seldom drank wine or beer. In the afternoon he usually took a walk, frequently to Birmingham, and spent some time at the office where his works were being printed. He supped at eight, the meal usually

consisting of vegetables, and retired to rest shortly after ten. He was extremely methodical in his habits and a rigid economist of time.

At Daventry he began the practice, which he continued up to within three or four days of his death, of keeping, in Peter Annet's system of shorthand, a diary in which he noted where he had been, the nature of his employment, what he had been reading, and any hints or suggestions of future work which had occurred to him, when he rose and the hour at which he went to bed. He was very methodical in his reading and in the alternation of his studies and relaxation. He never read a book without determining in his own mind when he would finish it. Had he a work to transcribe, he would fix a time for its completion. At the beginning of each year he arranged the plan he intended to pursue, and at the close he reviewed the general situation of his affairs and took stock of the progress he had made, noting whether the execution of his plan exceeded or fell short of his expectations. It was this regular apportionment of his time, and the habits of method and order in the arrangement of his business which he adopted in early life, and from which he never materially deviated, together with his uniformly good health, his industry and aptitude for rapid work, which enabled him to achieve what he did. It was, he says, a great advantage to him that he never was under the necessity of retiring from company in order to compose anything. Being fond of domestic life he got a habit of writing on any subject by the parlour fire with his wife and children about him, and occasionally talking to them without experiencing any inconvenience from such interruptions. When he was a young author (although

he did not publish anything until he was about thirty) strictures on his writings gave him some disturbance, though he believed even then less than they do most others ; but after some time things of that kind hardly affected him at all, and on this account he thinks he may be said to have been well formed for public controversy. But what always made him easy in any controversy in which he was engaged was his fixed resolution frankly to acknowledge any mistake that he might perceive he had fallen into. "That I had never been in the least backward to do this in matters of philosophy can never be denied."

Though he has been considered as fond of controversy, and that his chief delight consisted in it, yet it was far from being true. He was more frequently the defendant than the assailant. His controversies, as far as it depended upon himself, were carried on with temper and decency. He was never malicious, nor even sarcastic or indignant, unless provoked.

Priestley was a very busy man and a very industrious man, but he had not the power of sustained and concentrated application to a single subject which is the characteristic of men of great intellectual eminence. In this respect he was far inferior to his contemporaries Watt and Cavendish. His quick and active mind enabled him rapidly to assimilate the ideas of others, but it may be doubted, even in theology, whether he pushed his convictions and doctrinal beliefs beyond the limits reached by previous thinkers. His philosophy, as Huxley has pointed out, contains little that will be new to the readers of Hobbes, Spinoza, Collins, Hume and Hartley. "It does not appear," says his son, "that he spent more than six or eight hours per day in

business that required much mental exertion." In his diary he laid down the following daily arrangements of time for a minister's studies :—Studying the Scriptures, one hour. Practical writers, half-an-hour. Philosophy and History, two hours. Classics, half-an-hour. Composition, one hour—in all five hours. "All which," he adds, "may be conveniently dispatched before dinner, which leaves the afternoon for visiting and company, and the evening for exceeding in any article if there be occasion."

His son tells us that for many years of his life he never spent less than two or three hours a day in games of amusement, as cards and backgammon, but particularly chess, at which he and his wife played regularly three games after dinner and as many after supper. As his children grew up, chess was laid aside for whist or some round game at cards, which he enjoyed as much as any of the company. He was fond, too, of bodily exercise, and was particularly attached to his garden, in which he worked constantly. His laboratory also afforded him exercise, as he never employed an assistant, and never allowed anyone even to light his fire.

The attention, he says, which he paid to the phenomena of his own mind, made him sensible of some great defects in its constitution. He was, he says, from an early period, subject to a "most humbling failure of recollection," so that he sometimes lost all ideas of both persons and things that he had been conversant with. He says, "I have so completely forgotten what I have myself published, that in reading my own writings what I find in them often appears perfectly new to me, and I have more than once made

experiments the results of which had been published by me."

Apprised of this defect he never failed to note down as soon as possible everything that he wished not to forget. The same failing led him to devise and have recourse to a variety of mechanical expedients to secure and arrange his thoughts, which were of the greatest use to him in the composition of large and complex works, and what he says excited the wonder of some of his readers would only have made them smile had they seen him at work. "But by simple and mechanical methods one man shall do that in a month which shall cost another, of equal ability, whole years to execute. This methodical arrangement of a large work is greatly facilitated by mechanical methods, and nothing contributes more to the perspicuity of a large work than a good arrangement of its parts."

What he learned to know with respect to himself tended much, he says, to lessen both his admiration and his contempt of others.

"Could we have entered into the mind of Sir Isaac Newton, and have traced all the steps by which he produced his great works, we might see nothing very extraordinary in the process. And great powers with respect to some things are generally attended with great defects in others; and these may not appear in a man's writings. For this reason, it seldom happens but that our admiration of philosophers and writers is lessened by a personal knowledge of them."

Great defects may, however, be more than counterbalanced by great excellences, and accordingly he hopes that his defect of recollection, possibly due to a want of sufficient coherence in the association of ideas formerly impressed, might arise from a mental constitution more

favourable to new associations, so that what he lost with respect to memory may have been compensated by what is called invention, or new and original combinations of ideas.

In the domestic relations of life he was uniformly kind and affectionate. As was truly said of him on Darton's portrait, "Not malice itself could ever fix a stain on his private conduct or impeach his integrity."

CHAPTER IX

The Birmingham riots of 1791.

THE picture which Priestley drew of his life in Birmingham at this period, as given in the autobiographical sketch published after his death, is almost dramatic in its pathos when we bear in mind that it was written almost on the eve of that maniacal outburst of popular passion which eventually drove him from our shores. He said he considered his settlement at Birmingham as the happiest event in his life, as being highly favourable to every object he had in view, philosophical or theological. He thanks God that his prospects are better than they have ever been before, that his own health, and that of his dear wife, is better established, and his hopes as to the disposition and future settlement of his children are satisfactory. He has particular reason to be grateful for the happy temperament of body and mind he owes to his parents, and for the fundamentally good constitution of body to which was due an even cheerfulness of temper which had but few interruptions. Another great subject of thankfulness to a good Providence was his perfect freedom from any embarrassment in his circumstances, for his supplies had been always equal to his wants, and his indifference to an increase of fortune was the means of attaining it.

"When," he says, "I began my experiments I expended on them all the money I could possibly raise, carried on by my ardour in philosophical investigations, and entirely regardless of consequences, except so far as never to contract any



THE PILLAGING OF PRIESTLEY'S HOUSE DURING THE BIRMINGHAM RIOTS

debt. . . . But having succeeded, I was in time more than indemnified for all that I had expended.

"Yet frequently, as I have changed my situation, and always for the better, I can truly say that I never wished for any change on my own account. I should have been contented even at Needham if I could have been unmolested and had bare necessities. This freedom from anxiety was remarkable in my father, and therefore is in a manner hereditary to me; but it has been much increased by reflection, having frequently observed, especially with respect to Christian ministers, how often it has contributed to embitter their lives without being of any use to them. Some attention to the improvement of a man's circumstances is no doubt right, because no man can tell what occasion he may have for money, especially if he have children, and therefore I do not recommend my example to others. But I am thankful to that good Providence which always took more care of me than ever I took of myself."

This serene contentment is reflected in his correspondence at this period, and we find further evidence of it in the letters of his friends.

"I esteem it a singular happiness to have lived in an age and country in which I have been at full liberty both to investigate, and by preaching and writing to propagate, religious truth; that though the freedom I have used for this purpose was for some time disadvantageous to me, it was not long so, and that my present situation is such that I can, with the greatest openness, urge whatever appears to me the truth of the Gospel, not only without giving the least offence, but with the entire approbation of those with whom I am particularly connected."

Dr Aikin, visiting him in 1784, says in a letter to Mrs Aikin :—

"The great philosopher, with his simple, bland, unaffected manners, contented and happy, and declaring that he had not a wish on earth unsatisfied, gave me infinite delight."

These halcyon days were, however, but as the calm before the storm, and the contented and happy

philosopher had soon need of all his philosophy, and of all his Christianity too, in face of the ungoverned fury of the mob which, to use Wedgwood's words, swept like a hurricane over him and his friends.

The 14th of July 1791—the anniversary of the French Revolution—was celebrated in several towns in England without interruption or any untoward circumstance; that day, however, was long remembered by the inhabitants of Birmingham with feelings akin to horror. It is certain that the popular rising which then took place in that town was in the outset mainly directed against Priestley. The course of events proves this. As it happened, the appetite in the mob for mischief grew by what it fed upon, and many others, his friends and political and religious associates, were involved in the disaster which overtook him. For it would appear that those who, in the first instance, instigated and directed the outrage lost all control over the forces which they invoked, and the rising, which in the beginning was intended to visit Priestley with the vengeance which the Cracow mob inflicted on his prototype Socinus, developed into a wild anarchical riot, confused and purposeless except as gratifying a wanton lust for rapine and destruction. Many contemporary accounts exist of the Birmingham riots of 1791, and although, as might be expected from the temper of the times, some of the narratives are not wholly uncoloured by prejudice and the partisan spirit of political and religious feeling, it is not difficult to put together a true view of an episode which profoundly affected all parties and sent a thrill of apprehension and alarm throughout the country. Political feeling at the period ran high. Europe had recently witnessed the spectacle of a

revolution which had filled the governing classes of every state with awe and even terror, and the great masses of the people in this and other countries, to whom all political power was denied, were beginning to realise what might be possible to concerted action properly organised and vigorously pressed. Every bureaucracy was in a state of trepidation. The political atmosphere was heavily charged with electricity and no one could foretell where and when the next thunderbolt would descend. Naturally enough the great vested interests in Church and State looked askance at, and were disquieted by, these periodical celebrations of such an event as the destruction of the Bastille and all that it symbolised, with their odes to Liberty, Fraternity and Equality, and their impassioned appeals to Demos, and the rising hopes of a people grown restive and impatient under what they were taught to believe was political thralldom. It required but a small spark to bring about a conflagration, and designing and unscrupulous men saw in the approaching anniversary of the memorable 14th of July an opportunity of which they were determined to take advantage. Priestley had himself, unwittingly, laid the train which brought about the catastrophe.

“Dr Priestley,” says Corry, writing in 1804, “from the commencement of his residence at Birmingham, had undoubtedly turned his attention too much from the luminous field of philosophic disquisition to the sterile regions of polemic divinity and the still more thorny paths of polemic politics. His tracts on these subjects amounted to upwards of thirty, and from his celebrity they had a very general circulation. As a philosopher he clearly saw defects in the most perfect of human institutions, and expressed himself with a boldness and freedom which alarmed the neighbouring clergy of the

Established Church, and excited their resentment. The labouring classes in Birmingham certainly looked upon him as a disaffected and dangerous man. Incapable of deep reflection themselves, they abhorred his Unitarian principles as subversive of Christianity, and the idea that the Church was in danger was propagated among them by men of deeper discernment, who wished to render Dr Priestley odious and unpopular. A very considerable number, however, of the more enlightened inhabitants, who were convinced of the Doctor's integrity as a man, sincerity as a preacher, and superlative merit as a philosopher, were his strenuous advocates and admirers. The collision of parties became every day more violent, and the events which were daily transacting in France kept alive the jealousy arising from uncongenial opinions."

A contemporary account states: The vigorous and repeated attempts of the Dissenters to obtain a repeal of the Corporation and Test Laws [repealed in 1828], excited much alarm and apprehension amongst many of the Established clergy, and were most forcibly felt by those residing in Birmingham. The name and writings of Dr Priestley were as much dreaded by his opponents as they were admired by his friends; and as he long resided near this town, and was eminently conspicuous in his endeavours to procure a repeal of these laws, and in the promulgation of Unitarian doctrines, it is not surprising that his sentiments should have been represented to the lower classes of the people as dangerous to the Church and State.

Attacks made upon his principles and motives in different pulpits were answered from the Press, and produced among other things his *Familiar Letters Addressed to the Inhabitants of Birmingham*, in which his opponents are combated with much force and severity. In the course of his controversial publications Priestley had made a comparison of the progress of free inquiry

to the action of gunpowder. The conclusion of the passage ran thus :—

“The present silent propagation of truth may even be compared to those causes in Nature which lie dormant for a time, but which in proper circumstances act with the greatest violence. We are, as it were, laying gunpowder, grain by grain, under the old building of error and superstition, which a single spark may hereafter inflame, so as to produce an instantaneous explosion ; in consequence of which that edifice, the erection of which has been the work of ages, may be overturned in a moment, and so effectually as that the same foundation can never be built upon again.”

This paragraph became to the enemies of the Dissenters a common topic of allusion, and was read in the House of Commons as an unquestionable proof of the dangerous designs of that body with respect to the constitution of this country. Hence the mischievous thinkers found no difficulty in persuading the unthinking actors that the real intentions of the Dissenters were to destroy the churches.

That mischief was being deliberately planned in view of the coming anniversary was certainly known to not a few of those in authority, some of whom from their position were responsible for the order and good government of the town. Some days before the outbreak a number of copies of a seditious hand-bill had been left in a public-house by an unknown person, and this had been copied and circulated throughout the town, causing a general ferment in the minds of the lowest class of the people. Its character was such that the magistrates promptly offered a reward of one hundred guineas for the discovery of the Writer, Printer, Publisher or Distributer of the inflammatory hand-bill. But notwithstanding that the Dissenters themselves

afterwards offered an additional reward of one hundred guineas, and the Government also proclaimed a further reward of one hundred pounds, no clue was ever obtained to the persons concerned in its preparation or distribution. Such, however, was the feeling of apprehension in the minds of those who were about to take part in the proposed celebration that it was determined to publish the following advertisement in the *Birmingham Chronicle* :—

BIRMINGHAM COMMEMORATION OF THE FRENCH REVOLUTION.

“Several hand-bills having been circulated in the town which can only be intended to create distrust concerning the intention of the meeting, to disturb its harmony and inflame the minds of people, the Gentlemen who proposed it think it necessary to declare their entire disapprobation of all such hand-bills and their ignorance of the authors. Sensible themselves of the advantages of a Free Government, they rejoice in the extension of Liberty to their Neighbours, at the same time avowing, in the most explicit manner, their firm attachment to the Constitution of their own Country, as vested in the Three Estates of the King, Lords and Commons. Surely no *Free-born Englishman* can refrain from exulting in this addition to the general mass of human happiness. It is the cause of *Humanity*, it is the cause of the People.

“BIRMINGHAM, July 13, 1791.”

We learn from a letter in the same newspaper, written a few days later by Mr William Russell, Priestley's friend, and himself, with his family, a sufferer in the events which followed, that in spite of this disclaimer there was still good grounds for believing that evil was brewing. He says that on the morning of the 14th many rumours of the probability of a riot were brought to the friends of the meeting; and as there was too much reason to think that means had been used to pro-

mote one, they determined to postpone the intended dinner and prepared a notice to that effect.

"This," says Mr Russell, "was sent to the printer, but before he had composed it, Mr Dadley, the master of the hotel, attended, in consequence of having the Dinner countermanded, and represented that he was sure there was no danger of any tumult, and recommended that the Dinner might be held as was intended; only proposing that the gentlemen should take care to break up early, and then all danger would be avoided. This measure was then adopted, and orders given to the printer to suppress the hand-bill. Accordingly there was a meeting of eighty-one gentlemen, inhabitants of the town and neighbourhood, at the great room in the hotel, where they dined and passed the afternoon with that social, temperate and benevolent festivity which the consideration of the great event that has diffused liberty and happiness among a large portion of the human race inspired."

Mr Russell continues :—

"It is but justice to the liberality and public spirit of an inglorious artist of this town to mention that he decorated the room upon this occasion with three elegant emblematic pieces of sculpture, mixed with painting, in a new style of composition. The central piece was a finely executed medallion of His Majesty, encircled with a Glory, on each side of which was an alabaster Obelisk; one exhibiting Gallic Liberty breaking the bands of Despotism, and the other representing British Liberty in its present enjoyment.

"A truly respectable gentleman [Captain Keir], a member of the Church of England, was chairman; others of that profession were of the company, nor was a single sentiment uttered, or, I believe, conceived, that would hurt the feelings of any one friend to liberty and good government under the happy constitution we are blessed with in this kingdom."

The mob, if they thought at all, thought otherwise. Although, we are told, the utmost harmony prevailed at the festive board, and the company dispersed without the least disturbance, they found a considerable number

of the populace assembled in the neighbourhood of Temple Row, evidently bent on mischief. The crowd remained in the vicinity of the hotel, their numbers gradually increasing, for a couple of hours after Captain Keir and his friends had left. Whether the people expected Priestley to be of the company, and fancied he was being detained in the hotel on account of their threatening attitude, is uncertain. As a matter of fact he had not been at the dinner. Suddenly the cry of "Church and King!" was raised, and at that signal every window in the front of the hotel was promptly broken. Thereupon, as if by a common impulse, or if as acting under direction, the crowd swept onwards to the New Meeting, where Priestley preached; this they assailed, we are told, with incredible fury. The New Meeting was erected in 1730: it was described as a considerable pile, "more remarkable for plainness and simplicity than for any uncommon elegance of workmanship or superb style of decoration. The vestry contained a valuable collection of books for the use of the Society which assembled there." The gates and doors were soon burst open, the pews demolished, the cushions and fragments carried out and burnt in front of the building, and at length fire was carried in which consumed it to the outer walls. The mob was now roused to frenzy. Some of the magistrates strove to quell the riot, and even those who had connived at the outrage grew alarmed at the dangerous temper which they had roused. But the infuriated rabble by this time was thoroughly out of control, and no sufficient force was at hand to cope with it. The Old Meeting-House was next demolished with the regularity of workmen employed for the purpose. A party armed with crow-

bars, bludgeons, etc., tore down the pulpit, pews and galleries, and burnt them in the burying-ground, afterwards setting fire to the body of the meeting-house. The cry of "Church and King!" was again raised, and the rioters marched in a body to Fair Hill, about a mile from the town, where Priestley resided. His house was described by Aikin as "a most comfortable and pleasing retreat." "Although," we are told, "it belonged to a gentleman who was deservedly a favourite of the poor, yet because it was the dwelling of Dr Priestley it was doomed to destruction," and was "attacked with the most savage and determined fury." Priestley, when the news was brought to him by his friend, Samuel Ryland, of the destruction of the Meeting-Houses and of the impending attack on Fair Hill, was playing backgammon with his wife, as was his custom after supper. He could hardly be persuaded of the danger in which he stood, and it was with difficulty that Ryland hurried him and Mrs Priestley into the chaise which was waiting at the door. He and his wife were then quickly driven to Showell Green, the residence of his friend, William Russell, leaving his son William Priestley, and some other young persons, with the servants to protect the property. What followed may best be gleaned from the graphic narrative of Miss Martha Russell, written within a few days of the occurrence, but first published in *The Christian Reformer* of 1835, Vol. II. p. 293:—

"As we were at supper, Tolley, our footman, came in with a countenance as pale as ashes, and told my father a messenger was just arrived to inform him that a mob had collected and set fire to the New Meeting-House, and were then employed in destroying the Old Meeting-House also, and they declared their intention to come from thence to Dr Priestley's house

and then to ours, and that no magistrate appeared or could be found to disperse them. Consternation and alarm now filled our minds. My father ordered his horse, intending to go and meet the mob, and search out the justices to quell it. Whilst he was loading his pocket-pistols to carry with him, a chaise drove up to the door with Dr and Mrs Priestley and Mr Samuel Ryland. The latter had taken the alarm, and, procuring a chaise, had hurried the Doctor and Mrs P. away from their house, fearing the mob would be there immediately. So great was the panic he had felt and inspired them with that they had secured nothing, but seemed as if happy and fortunate in escaping with their lives. We all united in begging my father not to leave the house, and urged the danger he would be in by meeting such an ungovernable concourse of people, and that, being alone, he could do nothing towards quelling them, and no doubt but our friends in Birmingham would some of them exert themselves and stir up the magistrates without his running such a risk. He would, however, hear nothing of it, but declared 'he would be his own master that night.' Seeing him resolved to go, Mrs Priestley requested him to bring her a small box of money she had in her chamber, and Dr P. wished for his pocket-book, which contained something of value, and which he had left on the table in the parlour, so great was their hurry and alarm. . . . We walked up and down the foot-road leading to town in a dreadful state of suspense and apprehension, clearly discerning the fire from the two Meeting-Houses, and distinctly hearing the shouts of the mob. . . .

"In about three hours my father returned and informed us he went first to Dr Priestley's house, where he found William Priestley, whom he instructed to begin and move all the Doctor's manuscripts he thought most likely to be valuable, by means of persons in the neighbourhood whom my father had brought for that purpose, and on whom he could rely, to a place in the vicinity he had fixed upon as secret and secure. This he urged him to do as expeditiously and quietly as possible, and to continue this employ, including also any other valuables he recollected, till my father should send him word to stop, not attending to any reports that might be brought him. My father then rode on to town as far as Digbeth, and there

meeting the mob, he tried in vain to proceed. He met many of his friends, all of whom requested him to return, telling him he did not hear the threats that were uttered against him. At length, one of them, I believe Mr J. F——, suddenly turned his horse, and giving him a cut with his whip, the press was so great and the spirit of the horse so roused my father found himself obliged in a manner to return. Arriving at Dr Priestley's gate before the mob, he stationed himself within-side till the mob came up, and then addressed them, endeavouring to induce them, by fair words and money, to desist and return home. At first they seemed a little pacified and inclined to listen, till one more loud than the rest, and who had the appearance of a ringleader, cried out, 'Don't take a sixpence of his money : in the riots of '80 in London a man was hanged for only taking sixpence.' They all then vociferated, 'Stone him, stone him !' and began to fling stones. My father then, finding it rashness to brave two or three thousand men, turned his horse and rode up to the house, telling William Priestley that he must desist and take as much care of the house as he could, and advising him to make all the doors and windows as secure as possible. He then rode off home and informed us he did not think our house yet in danger, but thought we had better remove with Dr and Mrs P. to Mr Thomas Hawkes, about half a mile off, for fear we should be suddenly surprised. During this time several messages were sent, and friends came to warn us of our danger. All seemed to apprehend the mob would visit us, and we had been advised to set out a barrel of ale on the lawn, thus attempting to pacify them and persuade them to desist. This done, and proper persons left to watch, we all walked up to Mr Hawkes's. Here we found the family up and under great apprehension ; and here we soon heard the shouts of the mob at Dr Priestley's house (and I shall never forget what dreadful and hideous shouts they were), intermingled with a loud noise of battering against the walls, and such a confusion of cries, huzzas, etc., as cannot be imagined. Soon the flames burst forth, and then all seemed quiet. What were the emotions of our minds at this moment no one can imagine unless they had beheld our countenances and heard the broken, short sentences that formed all the conversation which passed amongst us : yet

the extreme agitation of our minds did not prevent us from admiring the divine appearance of the excellent Dr Priestley. No human being could, in my opinion, appear in any trial more like divine, or show a nearer resemblance to our Saviour, than he did then. Undaunted he heard the blows which were destroying the house and laboratory that contained all his valuable and rare apparatus and their effects, which it had been the business of his life to collect and use. All this apparatus, together with the uses he had made of them, the laborious exertions of his whole life, were being destroyed by a set of merciless, ignorant, lawless banditti, whilst he, tranquil and serene, walked up and down the road with a firm yet gentle pace that evinced his entire self-possession, and a complete self-satisfaction and consciousness which rendered him thus firm and resigned under the unjust and cruel persecution of his enemies; and with a countenance expressing the highest devotion, turned as it were from this scene and fixed with pure and calm resignation on him who suffered the administration of this bitter cup. Not one hasty or impatient expression, not one look expressive of murmur or complaint, not one tear or sigh escaped him; resignation and a conscious innocence and virtue seemed to subdue all these feelings of humanity.

“About four o'clock my father returned and informed us that as the fire had consumed the doctor's house the mob were nearly dispersed, half drunk, having been up to their ankles in wine in his cellar, where they had broke the necks off all the bottles and inundated the cellar with that portion of their contents they could not drink; that the fields round were now covered with these fiends sleeping from drunkenness and fatigue, and that as day was now come he thought it most likely they would disperse entirely, and that consequently we might return home again. Accordingly we set off, and never shall I forget the joy with which I entered our own gates once more. . . . A room was prepared for the Doctor and Mrs P. We all looked and felt our gratitude; but the Doctor appeared the happiest amongst us. Just as he was going to rest, expressing his thankfulness in being permitted to lie down again in peace and comfort, my father returned from Fair Hill with the intelligence that they were collecting again, and their threats were more violent than ever, that they swore to find

Dr P. and take his life. The chaise was now ordered with all speed, and instead of the much-desired rest the Doctor and Mrs P. were obliged to dress again and get into it, scarcely knowing whither to go. Mr Ryland accompanied them, and it was thought most advisable to take a by-road to Heath, where Mrs Finch, the Doctor's daughter, lived, near Dudley."

"He remained at Heath Forge," says another account, "until Saturday, July 16th, meanwhile writing to Lindsey and to his sister, Mrs Crouch, then living at Gildersome, fearing that she would receive false accounts through the newspapers. On the afternoon of that day he set off on horseback, with a servant, for Worcester, intending to catch the London mail that evening. But the fugitives lost their way on the Morfe, a common between Heath Forge and Bridgenorth, and wandered about all night. They, however, reached Kidderminster safely in the morning, and were met by Mr Ryland, who offered Priestley his own wig and coat by way of disguise. But the doctor declined. He had on a coat buttoned up to the chin, a wig and a cocked hat, with the point in front, his usual dress out of doors.' Mr Ryland accompanied Priestley as far as Worcester, and arrived just in time to take a place for him in the mail to London. He travelled all night, reaching London between six and seven in the morning of Monday, July 18th, and went to his friend Lindsey's in Essex Street, Strand."

Miss Russell's apprehensions proved to be only too well founded. Showell Green was destroyed, as were Bordesley Hall and Moseley Hall, and other houses in the vicinity of Moseley; Mr Ryland's house at Easy Hill, and Mr Hutton's house in High Street and his country seat at Wash Wood Heath.

On Sunday the rioters proceeded to King's Wood, seven miles from Birmingham, and destroyed the meeting-house and the dwelling of the Dissenting minister. For the greater part of three days the town was in a state of siege, the majority of the shops were closed and business was at a stand-still. Attempts were made to organise a force of constables, but the

number got together was insufficient to cope with the mob, and in an effort to protect Mr Ryland's house the police were beaten after a severe contest, and many were wounded. A number of the rioters lost their lives; one man was killed by the fall of a coping stone from Priestley's house and a number were wounded. At Easy Hill the drunken wretches in the cellars were overwhelmed by the falling in of the flaming roof, six were got out alive, but terribly burnt and bruised, whilst ten dead bodies were dug out of the ruins.

Late on Sunday night three troops of dragoons reached the town :—

“ Their arrival,” says a contemporary chronicler, “ was announced by the sound of their trumpets and the acclamations of the inhabitants. Anxiety, which had been strongly depicted in every face during the day, was succeeded by the smiles of joy and the congratulations of neighbours. The town was illuminated, the rioters, conscious of their delinquency, soon dispersed, and order was happily restored without bloodshed.”

The King, writing to Mr Secretary Dundas in approval of dragoons having been sent to Birmingham to quell the tumult, thus continues :—

“ Though I cannot but feel better pleased that Priestley is the sufferer for the doctrines he and his party have instilled, and that the people see them in their true light, yet I cannot approve of their having employed such atrocious means of showing their discontent.”

From Mr Lindsey's house Priestley sent the following letter to the *Birmingham Chronicle* :—

“ TO THE INHABITANTS OF THE TOWN OF BIRMINGHAM.

“ MY LATE TOWNSMEN AND NEIGHBOURS,—After living with you eleven years, in which you had uniform experience of my peaceful behaviour, in my attention to the quiet studies

of my profession and those of philosophy, I was far from expecting the injuries which I and my friends have lately received from you. But you have been misled. By hearing the Dissenters, and particularly the Unitarian Dissenters, continually railed at, as enemies to the present government in Church and State, you have been led to consider any injury done to us as a meritorious thing, and, not having been better informed, the means were not attended to. When the *object* was right you thought the *means* could not be wrong. By the discourses of your teachers, and the exclamations of your superiors in general, drinking confusion and damnation to us (which is well known to have been their frequent practice), your bigotry has been excited to the highest pitch, and nothing has been said to you to moderate your passions, but everything to inflame them; hence, without any consideration on your part or on theirs, who ought to have known and taught you better, you were prepared for every species of outrage, thinking that whatever you could do to spite and injure us was for the support of Government, and especially the Church. In *destroying us* you have been led to think *you did God* and your country the most substantial *service*.

“Happily the minds of Englishmen have a horror of *murder*, and therefore you did not, I hope, think of *that*, though by your clamorous demanding of *me* at the hotel it is probable that at that time some of you intended me some personal injury. But what is the value of life when everything is done to make it wretched? In many cases there would be greater mercy in dispatching the inhabitants than in burning their houses. However, I infinitely prefer what I feel from *the spoiling of my goods* to the disposition of those who have misled you.

“You have destroyed the most truly valuable and useful apparatus of philosophical instruments that perhaps any individual in this or any other country was ever possessed of, in my use of which I annually spent large sums, with no pecuniary view whatever, but only in the advancement of science, for the benefit of my country and of mankind. You have destroyed a library corresponding to that apparatus which no money can re-purchase, except in a course of time. But what I feel far more, you have destroyed *manuscripts*, which have been the result of the laborious study of many years, and which I

shall never be able to recompose ; and this has been done to one who never did, or imagined you, any harm.

“ I know nothing more of the *hand-bill*, which is said to have enraged you so much, than any of yourselves, and I disapprove of it as much, though it has been made the ostensible handle of doing infinitely more mischief than anything of that nature could possibly have done. In the celebration of the French Revolution, at which I did not attend, the company assembled on the occasion only expressed their joy in the emancipation of a neighbouring nation from tyranny, without intimating a desire of anything more than such an improvement of our own Constitution, as all sober citizens, of every persuasion, have long wished for. And though, in answer to the gross and unprovoked calumnies of Mr Madan and others, I publicly vindicated my principles as a Dissenter, it was only with plain and sober argument, and with perfect good-humour. We are better instructed in the mild and forbearing spirit of Christianity than ever to think of having recourse to *violence* ; and can you think such conduct as yours any recommendation of your religious principles in preference to ours ?

“ You are still more mistaken if you imagine that this conduct of yours has any tendency to serve your cause or to injure ours. It is nothing but *reason* and *argument* that can ever support any system of religion. Answer your arguments and your business is done ; but your having recourse to *violence* is only a proof that you have nothing better to produce. Should you destroy myself, as well as my house, library and apparatus, ten more persons of equal or superior spirit and ability would instantly rise up. If these ten were destroyed one hundred would appear ; and believe me, that the Church of England, which you now think you are supporting, has received a greater blow by this conduct of yours than I and all my friends have ever aimed at it.

“ Besides, to abuse those who have no power of making resistance is equally cowardly and brutal, peculiarly unworthy of Englishmen, to say nothing of Christianity, which teaches us to do as we would be done by. In this business we are the sheep and you are the wolves. We will preserve our character, and hope you will change yours. At all events, we return you blessings for curses, and pray that you may soon

return to that industry and the sober manners for which the inhabitants of Birmingham were formerly distinguished.—I am,
your sincere well-wisher, J. PRIESTLEY.

“LONDON, July 19, 1791.

“P.S.—The account of the first toast at the Revolution Dinner in the *Times* of this morning can be nothing less than a malicious lie. To prove this a list of the toasts, with an account of all the proceedings of the day, will soon be published. The first of these was *The King and Constitution*, and they were all such as the friends of liberty, and of the true principles of the Constitution, would approve.”

One of the earliest letters of sympathy he received was from his steadfast friend and benefactor, Wedgwood. It was written from Weymouth, at that time the most fashionable seaside watering-place in England, and condoled with him on the “irreparable loss” he had “sustain’d from the brutality, or rather let us hope the temporary insanity” of his neighbours.

“If they had arisen merely from the ungovern’d madness of a mob from the lowest order of our species, one would then lament all its effects like those of a storm or hurricane, but if there is reason to believe that the rabble were acted upon and encouraged to such proceedings by those who should be their superiors, one cannot but perceive the too evident spirit of the times, or of the place at least, by which you and so many of your worthy neighbours have suffered.”

Wedgwood then earnestly begs his friend to let him know how he can be of service to him :—

“Instruct me in the means of doing it and I shall esteem it as one of the strongest instances of your friendship.”

Priestley’s reply was written from the house of his son-in-law, William Finch, Heath Forge, Birmingham, and was as follows :—

“Your very kind and sympathising letter was very acceptable to me. The shock was no doubt very great, but I thank God I

have been able to bear it without any loss of health, or, indeed, of spirits. I begin to suffer most from want of employment and absence from my family, which indeed is irksome to me. My wife behaved with the greatest heroism at the time, but continuing in the neighbourhood, and hearing continually of the bad spirit that prevails in the place, I perceived that her mind began to be affected by it. She cannot remove, as my daughter expects to be brought to bed in about a month, and she cannot bear that her mother should be absent at the time. This circumstance adds much to my difficulty. Could we go together to some distant place for a month we should be much more comfortable. One good thing has already come out of this evil—I have a kind letter from Mr John Wilkinson inviting us to any house of his, and bidding me not to regard any losses that money can repair.”

His brother-in-law promptly sent him £500 after the riots, and subsequently transferred to him £10,000 in the French funds. As these were afterwards non-productive he afterwards gave him an annuity of £200.

Immediately after the riots he received a great number of addresses and testimonials from his theological and philosophical admirers, and an address transmitted by Condorcet was sent to him from the French Academy of Sciences.

One of the earliest letters he dispatched from London was to Keir, under date July 22, 1791.

PRIESTLEY TO KEIR.

“I am very happy to see a copy of your letter to the printer of the *Birmingham Chronicle*, and in return enclose copies of my “Address to the Inhabitants of Birmingham,” and of Mr Russell’s “Account of the Proceedings on July 14th.” Both these have been in the London papers and I have just sent yours to the printer of the *Morning Chronicle*.

“I am happy to hear that all is quiet with you now, but when it will be proper for me to come to you I cannot tell. I fear not before the next Lunar Society. Whether I shall ever

have it in my power to collect another apparatus for experiments is quite uncertain, as indeed is, in a great measure, my settling again at Birmingham, though there is no place in the world that I should prefer to it.

“The extra copies of my last paper for the *Philosophical Transactions* are printed, and I shall soon send some to Mr Galton to be presented to each of the members of the Lunar Society.

“I beg my compliments to them, and as long as I live I shall with much satisfaction think of our many happy meetings.”

In a letter to Wedgwood, dated four days later, he sends two copies of his paper, and says :—

“I fear I shall not soon be able to furnish materials for another. Indeed, what I shall do, or where I shall settle, is uncertain. I shall, however, continue at Birmingham *if possible*, and resume all my pursuits, in which case I must thank you for a fresh stock of *retorts*, tubes, etc., etc., etc. This invasion of the Goths and Vandals I little foresaw, and hope it will never be repeated, as I fancy the *experiment* will not be found to answer.”

The next letter to Keir, dated July 29, 1791, is interesting as throwing further light upon the causes of the riots :—

“I never thought of returning to Birmingham till my friends there should think it safe and, on their accounts, advisable ; and this, I now begin to fear, will not be so soon as you intimate. However, I am ready to attend the first summons, and earnestly wish it may be before the next Lunar Society. But your meeting must not depend upon this event.

“With this I send each of you a copy of my late, and I fear *last*, paper for the *Philosophical Transactions*. I shall always recollect, with peculiar satisfaction and regret, our many cheerful and improving meetings ; and if not a constant, shall indulge the hope of being an occasional, attendant.

“You were certainly a better judge than I was of the *spirit of the times*. But even you could not have expected such brutal excesses as have taken place ; and yet I am willing to hope

much from *time*, from your¹ seasonable letter, and the representations of the more calm and reasonable members of the Church of England, if not from the interposition of Government and the execution of the laws, in which I *wish* for moderation.

"I lately dined with Mr Sheridan, who said I should meet Mr Fox.¹ He, however, was prevented from attending, but desired Mr Sheridan to say that he wished to take the matter up in whatever manner we should think proper, by motion in the House on the subject. They conceive that the encouragement given to this High Church spirit by the Court arises from their willingness to crush Mr Fox, who has taken our part, and that they hoped by these measures to intimidate us into silence.

"This I can hardly think to be the case, and I am unwilling to connect our cause with that of any political party; since upon the face of it, as you have clearly shown, it is wholly of a religious nature. However, I said there would be time enough to take our measures before the next meeting of Parliament."

Dr Withering, himself a sufferer, hastened to express his sympathy. Priestley replied to his letters as follows:—

"Your generous contribution towards the re-establishment of my philosophical apparatus cannot but give me satisfaction, though I am sorry to be so burdensome to my friends, especially my fellow-sufferers, among whom you are ranked. But what the country will do towards indemnifying us appears very distant and uncertain, and my claims will be liable to the greatest uncertainty, as the *proof* that may be required of my losses cannot be given.

"I am happy to find that your alarms and sufferings have no more affected your spirit and health than my own did mine, and that we may so soon expect your third volume.²

"It will be a considerable time, with every assistance that money can afford, before I can be at work again, and hardly

¹ Richard Brinsley Sheridan at that time represented Stafford in the House of Commons. Both he and Fox sympathised with Priestley and sought to secure him compensation for his losses.

² Withering's *Botanical Arrangement*, 2nd Ed. 3 vols. 1792.

ever to so much advantage as at Birmingham. Such assistance from philosophical friends I should in vain look for here, and as long as I live I shall look back with pleasure and regret to our Lunar meetings, which I always enjoyed so much and from which I derived so much solid advantage. If I could find the same *intelligence* in any club of Philosophers here, I could not find the same *frankness* which is the charm of all society.

"I have nearly printed *An Appeal to the Public* on the subject of the late riot, and shall direct the printer to deliver you a copy.

"I am sensible that it will more exasperate my enemies, but it is addressed to our common judges, and may conciliate *them*, at least in a course of time.

"I have lately written to Mr Watt, and desired him, or the Lunar Society as a body, to make a proposal to those who act for the country. I hope you will see the propriety of it and contribute to its effect."

The *Appeal* evidently cost Priestley much pains in its composition. Part of it was sent in sheets to his intimate friends in Birmingham, notably Dr Withering, Mr Galton and Mr Russell, who conferred together and with Captain Keir as to the advisability of publishing it. Like him they were sensible that it would certainly more exasperate his enemies. Captain Keir endeavoured to dissuade him from its publication, at least in its proposed form, saying that it would "irritate his professed enemies, and furnish them with a new source of abuse," and that he feared that "Government would become more remiss in prosecuting the magistrates and in protecting the Dissenters in future if they should meet with any passage that would give them offence."

On learning the opinion of his friends Priestley wrote to Wedgwood:—

"I have desired the printer to send you a copy of my *Appeal* on the subject of the riots, in order to have your opinion and advice with respect to publishing of it. Several of my friends

in Birmingham, viz., Dr Withering, Mr Keir and Mr Galton, think that it had better be suppressed, or published with many alterations by way of softening. Others, and especially my friends here, are for its speedy publication, or about the time of the meeting of Parliament. In this state of suspense I beg your perusal of it and your free opinion. I think that if I write at all it should not be with less spirit than I have usually shown, and that there is nothing more violent or offensive in *this* than in several of my preaching publications. But as others are interested in the event of this publication I am willing to be advised by them."

On August 24, 1791, at the Warwick Assizes, John Green, John Clifton and Bartholomew Fisher were indicted for that they, with one William Jones, at large, with others, to the number of fifty and more, did, on the 15th of July, unlawfully and riotously assemble and with force of arms begin to pull down the dwelling-house of Joseph Priestley, LL.D. The jury found Green and Fisher guilty and Clifton not guilty.

John Stokes, for beginning to pull down the Old Meeting-House in Birmingham, was acquitted, on account of the defects in the indictment. The following was Baron Perryn's sentence :—

"Prisoners, you have been convicted by very human and attentive juries of the enormous crimes of setting fire to and destroying the houses and property of your fellow-subjects in a manner as wanton as it was unprovoked. Your cry of 'Church and King!' was nothing but a pretext to commit depredation and robbery. The Law and Constitution is a sufficient shield to protect the Church and the sacred person of His Majesty and all his good subjects in their lives and property.

"At the same time the Law possesses sufficient energy and vigour to make examples of those bad citizens who wickedly and wantonly violate it.

"You, miserable criminals, are of that number, and it is necessary that your lives should atone for your crimes, as a public example. You must therefore be removed from this world ; and I most

earnestly recommend you to employ the short space of time which will be allowed to you to make your peace with your offended Creator, who alone can grant that mercy which you must not expect from your country."

Priestley's own account of these proceedings, as given in his *Memoirs*, is very naïve and even studiously dispassionate. He says:—

"About two years before I left Birmingham, the question about the 'Test Act' was much agitated both in and out of Parliament. This, however, was altogether without any concurrence of mine. I only delivered, and published, a sermon on the 5th of November 1789, recommending the most peaceable method of pursuing our object. Mr Madan, however, the most respectable clergyman in the town, preaching and publishing a very inflammatory sermon on the subject, inveighing in the bitterest manner against the Dissenters in general and myself in particular, I addressed a number of 'Familiar Letters to the Inhabitants of Birmingham' in our defence. This produced a reply from him and other letters from me. All mine were written in an ironical and rather a pleasant manner, and in some of the last of them I introduced a further reply to Mr Burn, another clergyman in Birmingham, who had addressed to me 'Letters on the Infallibility of the Testimony of the Apostles concerning the Person of Christ,' after replying to his first set of letters, in a separate publication.

"From these small pieces I was far from expecting any serious consequences. But the Dissenters in general being very obnoxious to the Court, and it being imagined, though without any reason, that I had been the chief promoter of the measures which gave them offence, the clergy, not only in Birmingham but through all England, seemed to make it their business, by writing in the public papers, by preaching and other methods, to inflame the minds of the people against me. And on occasion of the celebration of the anniversary of the French Revolution, on July 14, 1791, by several of my friends, but with which I had little to do, a mob, encouraged by some persons in power, first burned the meeting-house in which I preached, then another meeting-house in the town, and then my dwelling-house, demolishing my library, apparatus and, as far

as they could, everything belonging to me. They also burned, or much damaged, the houses of many Dissenters, chiefly my friends.

“The criminality of the magistrates and other principal High Churchmen at Birmingham in promoting the riot remains acknowledged. Indeed, many circumstances which have appeared since that time show that the friends of the Court, if not the Prime Ministers themselves, were the favourers of that riot, having, no doubt, thought to intimidate the friends of liberty by the measure.”

“The years following the riot of 1791,” wrote Mr Matthew Devonport Hill, “witnessed various displays of hostile sentiment. In preparation for a municipal dinner shortly after that event, of which a member of the powerful and wealthy party opposed to French principles bore the cost, the list of guests accustomed prior to the outbreak to be invited on public occasions had been sedulously cleared of adverse elements. By inadvertence, however, the name of Dr Parr was retained; and the sturdy divine, although he must have surmised that he would be the only representative of his opinions, duly obeyed the summons. The cloth being drawn, the Chairman proposed, as the Doctor no doubt expected, the toast of ‘Church and King.’

“Parr instantly started to his feet, proclaiming in a stern voice his dissent. ‘No, sir,’ said he, ‘I will not drink that toast. It was the cry of Jacobites; it is the cry of incendiaries. It means a Church without the Gospel, and a King above the Law!’”

CHAPTER X

Determines to leave England—His arrival in America—
Settles at Northumberland—His closing days—His
death.

PRIESTLEY's position in London for some time after his arrival there was very insecure, and so apprehensive were his friends of further outrage that it was thought necessary to provide him with a disguise and to arrange a plan of escape in case the house should be attacked. At first he was not allowed to appear in the streets. Ultimately he was moved to Tottenham, where he spent a month.

In the middle of October a house was taken for him in Hackney, but it was with difficulty that the landlord, who feared his property would be demolished, was persuaded to accept him as a tenant. Here, however, he proceeded to build himself a laboratory, and in a letter to Thomas Wedgwood, of October 18, 1791, he says :—

“ As soon as convenient I shall be obliged to your father if he will supply me, as usual, with such retorts as you make, viz., earthen tubes closed at the end and open, and some with two necks. Small *retorts, evaporating-dishes, mortars and levigators*. Perhaps your servants here can tell me the price at which I must estimate those that were destroyed by the riot. I must soon give in an account of my losses, and I fear that some person on your part must attend at Warwick to attest the value. Mr Nairn, Mr Parker and others have promised to attend. But I have prepared [proposed] a conference between my appraiser and those for the county in London, which, if they be disposed to do justice, will save much trouble and expense.

"Whether I shall be invited to succeed Dr Price is uncertain. Many apprehend public disturbance in consequence of my coming. I could not get a house let in my own name. A friend took it in his. I have, however, very handsome proposals from France, particularly the offer of a house completely furnished, two miles from Paris, and another polite invitation from Toulouse, to take up my residence in the South of France in 'a monastery which reason has recovered from superstition.'"

Priestley's claim for damages amounted to £3628, 8s. 9d. Hutton says his real loss was upwards of £4500 (Jewitt's *Life of Hutton*, p. 255). The Court allowed £2502, 18s. In the town of Birmingham property to the value of £50,000 was destroyed, of which sum £26,961, 2s. 3d. was finally paid by a rate on the Hundred, in which Birmingham is included (Sam Timmins, *Trans. Midl. Inst.*, 1875).

Lindsey, writing to his friend, Alexander of Yarmouth, under date October 15, 1791, mentioning Priestley, says:—

"He is very well, and with his wonted cheerfulness, which has never forsaken him. Sunday last he preached for me for the first time since he has been expelled by fire and destruction out of his own place of worship, and he does me that favour to-morrow again. He has at last, though very reluctantly, and much to the concern of his late beloved people, given up the thought of continuing the pastoral office among them, as the exercise of it would not probably be consistent with his personal safety and liberty; such is the temper of his many adversaries still, and so hostile to him."

The managers of other Dissenting chapels had not the courage of Lindsey and begged that he would refrain from preaching to their congregations. Eventually he was invited to take the position formerly occupied by his friend Price.

The rancour of his enemies now broke out afresh, and the most persistent efforts were made to damage and disparage him in the eyes of his congregation. His friends in the neighbourhood were advised to move their effects to some place of greater safety, as it was common rumour that his house was to be attacked on the succeeding anniversary of the Birmingham riot. His servants were afraid to remain for any length of time with him, and the tradespeople hesitated to take his custom. He was several times burnt in effigy along with Tom Paine. Coloured caricatures of him, of the grossest and coarsest kind, in which he was described as "the treacherous rebel and Birmingham rioter" were scattered broadcast. Insulting letters, in some of which he was likened to Guy Fawkes or the devil himself, were sent to him from all parts of the country, even from men calling themselves ministers of the Gospel. In one of these he was threatened with being burned alive before a slow fire. The Rev. Dr Tatham, Rector of Lincoln College, Oxford, whose biographer compared him with Warburton ("There is much of the same rough, unpolished strength in his language"), thus addressed him :—

"Long have you been the Danger of this country, the Bane of its Polity, and the Canker-worm of its Happiness. Long, too long, have your Principles tended to bereave it of its Religion, its Constitution, and consequently of its King."

Burke, to his everlasting shame, inveighed against him in the House of Commons, and many of his associates in the Royal Society shunned him.

His position in the Society became eventually so irksome that he withdrew from it, as he explains in the preface to his *Observations and Experiments on the*

Generation of Air from Water, which he published in pamphlet form at Hackney, with a dedication to the members of the Lunar Society.

In a letter to Withering, written from Clapton, October 2, 1792, he says :—

“ . . . One of the things that I regret the most in being expelled from Birmingham is the loss of your company and that of the rest of the Lunar Society. I feel I want the spur to constant exertion which I had with you. My philosophical friends here are cold and distant. Mr Cavendish never expressed the least concern on account of anything I had suffered, though I joined a party with which he was, and talked with them some time. I do not expect to have much intercourse with any of them.

“ I have, however, nearly replaced my apparatus, and intend not to be idle. I have already made some experiments relating to the *doctrine of phlogiston*, and when I have made a few more shall probably write something on the subject. I am surprised at the confidence with which the French chemists write ; but I cannot yet learn what they have to object to my last paper in the *Philosophical Transactions*. . . .

“ I was in hopes to have been able to pay my friends of Birm. a visit long before this time, but was always discouraged, so that I have now given up the thoughts of it, and must content myself with seeing as many of them as I can here. . . . I do not, however, think I shall continue here long. Though unwillingly, I shall some time hence follow my son to France. But as I can *do* nothing there I will stay here as long as I can.”

To what lengths the Government were determined to go was seen in their banishment, in 1793, of Thomas Fyshe Palmer, a gentleman of a highly respectable and opulent family in Bedfordshire, to Botany Bay for seven years, because he had been concerned in publishing a paper in favour of Parliamentary Reform ; and in their treatment of Mr Winterbotham, a Calvinistic minister of Plymouth Dock, on account of his political opinions.

The mock trial of Mr Winterbotham at Newgate and the four years' imprisonment which followed it, created a wide-spread feeling of indignation and alarm, and many families were constrained to leave the country in disgust. Among them was Priestley's friend and fellow-sufferer, the worthy Mr Russell, who on his way to Boston, New England, was captured with his family by a French privateer and thrown into prison in Brest.

Priestley, at length, also determined to follow them. It was however with the greatest reluctance that he came to that decision. It meant parting from affectionate and devoted friends to whom he was warmly attached, whose zeal to serve him and to minister to his wants far outweighed the hatred of those who sought to cover him with oblivion. It meant too the relinquishment in large measure of his philosophical pursuits since he could not hope to procure elsewhere the same facilities for inquiry that he enjoyed here. More than all it seemed to mean the relinquishment of what was still dearer to him—his active efforts in the propagation of Unitarianism. Lastly it meant in all human probability a lasting severance from the daughter to whom he was so tenderly attached. He was largely guided to his decision by consideration for his sons, since, as he says, he found that the bigotry of the country in general made it impossible for him to place them here with any advantage. His second son, William, had been some time in France, but on the breaking out of the troubles in that country he had embarked for America, where his two brothers, Joseph and Henry, met him. They had a project of founding a settlement near the head of the Susquehanna in Pennsylvania, and several of Priestley's

friends at home, among them Mr William Russell of Birmingham, a leader of the New Meeting-House, were directly interested in the scheme.

Priestley at length decided to throw in his lot with his sons, and in the preface to his *Fast and Farewell Sermons*, which he delivered to his Hackney congregation on the eve of his departure, he gave his reasons for leaving the country :—

“After the riots in Birmingham it was the expectation, and evidently the wish of many persons, that I should immediately fly to France or America. But I had no consciousness of guilt to induce me to fly from my country. On the contrary, I came directly to London, and instantly, by means of my friend, Mr Russell, signified to the King’s ministers that I *was* there and ready, if they thought proper, to be interrogated on the subject of the riots.

“Ill-treated as I thought I had been, not merely by the populace of Birmingham, for they were the mere tools of their superiors, but by the country in general, which evidently exulted in our sufferings, and afterwards by the representatives of the nation, who refused to inquire into the cause of them, I own I was not without deliberating upon the subject of emigration ; and several flattering proposals were made to me, especially from France, which was then at peace within itself and with all the world ; and I was at one time much inclined to go thither, on account of its nearness to England, the agreeableness of its climate, and my having many friends there.

“But I likewise considered that if I went thither I should have no employment of the kind to which I had been accustomed ; and the season of active life not being, according to the course of nature, quite over, I wished to make as much use of it as I could. I therefore determined to continue in England, exposed as I was not only to unbounded obloquy and insult, but to every kind of outrage ; and after my invitation to succeed my friend Dr Price I had no hesitation about it. . . .”

He then goes on to show how insecure his position

was, and how impossible it was to follow his avocations in peace, in face of the odium and insult he continually met with:—

“ These facts not only show how general was the idea of my particular insecurity in this country, but what is of much more consequence, and highly interesting to the country at large, an idea of the general disposition to rioting and violence that prevails in it, and that the Dissenters are the objects of it. Mr Pitt very justly observed, in his speech on the subject of the riots at Birmingham, that it was ‘ the effervescence of the public mind.’ Indeed, the effervescible matter has existed in this country ever since the civil wars in the time of Charles I., and it was particularly apparent in the reign of Queen Anne. But the power of Government under the former princes of the House of Hanover prevented its doing any mischief. The late events show that this power is no longer exerted as it used to be, but that on the contrary there prevails an idea, well or ill founded, that tumultuary proceedings against Dissenters will not receive any effectual discouragement.

“ After what has taken place with respect to Birmingham, all idea of much hazard for insulting and abusing the Dissenters is entirely vanished; whereas the disposition to injure the Catholics was effectually checked by the proceedings of the year 1780. From that time they have been safe, and rejoice in it. But from the year 1791 the Dissenters have been more exposed to insult and outrage than ever.

“ The necessity I was under of sending my sons out of this country was my principal inducement to send the little property that I had out of it too; so that I had nothing in England besides my library, apparatus and household goods.

“ By this I felt myself greatly relieved, it being of little consequence where a man already turned sixty ends his days. Whatever good or evil I have been capable of is now chiefly done; and I trust that the same consciousness of integrity which has supported me hitherto will carry me through anything that may yet be reserved for me. Seeing, however, no great prospect of doing much good, or having much enjoyment here, I am now preparing to follow my sons; hoping to be of some use to them in their present unsettled state, and that Providence

may yet, advancing in years as I am, find me some sphere of usefulness with them."

He then goes on to deal with the charge that he was a factious, political parson who preached sedition :—

"As to the great odium that I have incurred, the charge of *sedition*, or my being an enemy to the constitution or peace of my country, is a mere pretence for it; though it has been so much urged that it is now generally believed, and all attempts to undeceive the public with respect to it avail nothing at all. The whole course of my studies from early life shows how little *politics* of any kind have been my object. Indeed, to have written so much as I have in *theology*, and to have done so much in *experimental philosophy*, and at the same time to have had my mind occupied, as it is supposed to have been, with factious politics, I must have had faculties more than human."

It is true, he says, he wrote a pamphlet "On the State of Liberty in this Country" at the time of Wilkes's election for Middlesex, and at the request of Franklin he wrote an address to the Dissenters on the subject of the approaching rupture with America; but he has nothing to reproach himself with on that score, and posterity agrees with him. His connection with the Marquis of Lansdowne was in no sense political. "Although," he says, "I entered into almost all his views, as thinking them just and liberal, I never wrote a single political pamphlet, or even a paragraph in a newspaper, all the time that I was with him, which was seven years."

He had never preached a political sermon in his life, unless such as he believed all Dissenters usually preached on the 5th of November in favour of civil and religious liberty may be said to be political. Even on those occasions he had never advanced any sentiment that would have made him until then obnoxious to the

administration of this country. The doctrines he adopted when young, and which were even popular then (except with the clergy, who were at that time generally disaffected to the family on the throne), he could not now abandon merely because the times were so changed that they had become unpopular and the expression of them hazardous.

Although he did not disapprove of societies for political information, he never was a member of one, nor did he ever attend any public meeting if he could decently avoid it.

“If, then, my real crime has not been *sedition*, or *treason*, what has it been? For every *effect* must have some adequate *cause*, and therefore the odium that I have incurred must have been owing to something in my declared sentiments or conduct that has exposed me to it. In my opinion it cannot have been anything but my open hostility to the doctrines of the Established Church, and more especially to all civil establishments of religion whatever. This has brought upon me the implacable resentment of the great body of the clergy; and they have found other methods of opposing me besides *argument* and that use of the *press* which is equally open to us all. They have also found an able ally and champion in Mr Burke, who (without any provocation except that of answering his book on the French Revolution) has taken several opportunities of inveighing against me in a place where he knows I cannot reply to him, and from which he also knows that his accusation will reach every corner of the country and consequently thousands of persons who will never read any writings of mine. They have had another, and still more effectual vehicle of their abuse in what are called the *treasury newspapers*, and other popular publications.

“I could, if I were so disposed, give my readers many more instances of the bigotry of the clergy of the Church of England with respect to me which could not fail to excite in generous minds equal indignation and contempt; but I forbear. Had

I, however, foreseen what I am now witness to, I certainly should not have made any attempt to replace my library or apparatus, and I soon repented of having done it. But this being done, I was willing to make some use of both before another interruption of my pursuits. . . . I hoped to have had no occasion for more than one, and that a final, remove. But the circumstances above mentioned have induced me, though with great and sincere regret, to undertake another, and to a greater distance than any that I have hitherto made. . . . And I trust that the same good Providence which has attended me hitherto, and made me happy in my present situation, and all my former ones, will attend and bless me in which may still be before me. In all events the will of God be done.

“I cannot refrain from repeating again that I leave my native country with real regret, never expecting to find anywhere else society so suited to my disposition and habits, such friends as I have here (whose attachment has been more than a balance to all the abuse I have met with from others), and especially to replace one particular Christian friend, in whose absence I shall, for some time at least, find all the world a blank. Still less can I expect to resume my favourite pursuits with anything like the advantages I enjoy here. In leaving this country I also abandon a source of maintenance which I can but ill bear to lose. I can, however, truly say that I leave it without any resentment or ill-will. On the contrary, I sincerely wish my countrymen all happiness; and when the time for reflection (which my absence may accelerate) shall come they will, I am confident, do me more justice. They will be convinced that every suspicion they have been led to entertain to my disadvantage has been ill founded, and that I have even some claim to their gratitude and esteem. In this case I shall look with satisfaction to the time when, if my life be prolonged, I may visit my friends in this country; and perhaps I may, notwithstanding my removal for the present, find a grave (as I believe is naturally the wish of every man) in the land that gave me birth.”

As the time of his departure drew near his friends vied with each other in their expressions of esteem and affection and many evidences of their regret were

offered to him. Among these was a silver inkstand from some of his admirers in the University of Cambridge, on which was an inscription of their sorrow "that this expression of their esteem should be occasioned by the ingratitude of their country."

On April 8, 1794, Priestley and his wife set sail from London, and arrived at New York on June 4.

On the way out he wrote some *Observations on the Cause of the Present Prevalence of Infidelity*, which he prefixed to a new edition of his *Letters to the Philosophers and Politicians of France*.

Alas! one of the most distinguished of those philosophers and politicians was even then no more. Coffinhal had pronounced his judgment, declaring "the Republic has no need of men of science," and whilst Priestley was on the high seas his great protagonist, Lavoisier, more unfortunate even than he, met his death on the scaffold.

"Such was the treatment bestowed upon the best of their citizens by two nations which considered themselves as without exception the most civilised and enlightened in the world!"

Priestley was well received in New York, many people meeting him on landing, and he was presented with addresses of welcome from various societies. After a stay of about a fortnight he proceeded to Philadelphia and received an address from the American Philosophical Society, and by a unanimous vote of the trustees was offered the Professorship of Chemistry in the University of Philadelphia.

In the following July, in order to escape from the heat of the city, he moved to Northumberland, a town about a hundred and thirty miles north-west of Phila-

delphia and situated at the confluence of the north-east and west branches of the Susquehanna, near to which place his eldest son, together with certain other persons, mainly Englishmen, projected a settlement. Priestley himself had no pecuniary interest, as has been stated, in the undertaking, and he was not consulted in its formation, nor had he even decided to join it if carried into effect. We learn from his son's account that the scheme of settlement was not to be confined to any particular class or character of men, religious or political. It was set on foot to be, as it were, a rallying point for the English, who were at that period emigrating to America in great numbers, and who, it was thought, would be more happy in society of the kind they had been accustomed to than they would be if dispersed through the whole of the States.

Owing to disagreements among the projectors, the scheme of the settlement fell through. Priestley, however, who was charmed with the beauty of its situation and the nature of its surroundings, determined to settle at Northumberland. Although at that time remote from any considerable town it was obviously destined to become a great thoroughfare. It was apparently healthy and less enervating, at least in summer time, than Philadelphia. Living was cheaper there than in that city, and he would be more free from care and more at liberty to follow his own pursuits than if burdened with the responsibilities of teaching. Lastly, his poor wife, who had never recovered from the shock of the Birmingham riots, needed rest and quiet. On these grounds, therefore, he decided to decline the offer of the Professorship at Philadelphia, as well as an invitation to take charge of an Unitarian congregation at

New York, and to spend his remaining days in peace and retirement on the beautiful spot he had chosen. The year before his death he was offered the principalship of the University of Pennsylvania in succession to Dr Euen, but this office also he declined.

On his first settling at Northumberland in 1795 he was mainly occupied with his theological and metaphysical studies. During this year he published the work which had occupied him during his voyage from England, his *Fast and Farewell Sermons*, some tracts in defence of Unitarianism, and the third part of his *Letters to a Philosophical Unbeliever*, in answer to Paine's *Age of Reason*, and he continued his *Church History from the Fall of the Western Empire to the Reformation*. In the house he had first occupied, which was barely sufficient in size to contain the family, he had little opportunity or convenience for doing experimental work.

Still, he made some observations on the analysis of air, and continued his inquiries on the generation of air from water.

Having determined to make Northumberland his home, he proceeded to build a house more suitable to his needs and pursuits, and, as his letters of the period show, its planning and arrangement gave him much thought and greatly interested him.

The house, which still exists, is similar in character to many middle-class American houses built in the country, a plain substantial erection, covered with match-boarding and fitted with jalousies, and to the front a loggia or verandah. The laboratory is a small building to the side, partially shaded by a large, wide-spreading tree.

In the autumn of this year he lost his youngest son, Henry, a bright and intelligent youth, of whom he was

remarkably fond. This loss greatly affected him, for he had hopes that the young man would follow him in his theological and philosophical pursuits, to which he had shown an inclination. The death of his son was even more profoundly felt by his wife, whose health and spirits now began rapidly to decline, and she too passed away a few months later.

"Through life," says her son, "she had been truly a helpmeet for him; supporting him under all his trials and sufferings with a constancy and perseverance truly praiseworthy, and who, as he himself, in noting the event in his diary, justly observes, 'was of a noble and generous mind, and cared much for others and little for herself through life.'"

At about this period he preached and printed another of his defences of Unitarianism and completed his *Church History*, and began the compilation of his last treatise in defence of phlogiston.

He spent the spring of 1796 in Philadelphia, where he delivered a series of lectures on the evidences of revelation to crowded audiences, including most of the members of the United States Congress, at that time sitting in Philadelphia, and of the executive officers of the Government. He delivered a second series on the same subject in the spring of the following year, but with less success, partly owing, his son imagines, to the novelty of the thing having passed away, and partly from prejudices that began to be excited against him on account of his supposed political principles. In reality Priestley took even less interest in the politics of America than he had done in those of his own country. He seldom read the debates in Congress, and beyond Adams and Jefferson he knew few of the leading politicians. He never attended a political meeting or

took part directly or indirectly in an election, and excepting an article in a newspaper called "Aurora," or "Maxims of Political Arithmetic," and signed "A Quaker in Politics," he wrote nothing on the subject of politics. At that period political feeling ran high and politics were the one subject of conversation, and to some extent, therefore, he could not escape their discussion, but it was noticed that he always argued on the side of liberty. As regards British politics his speculations went no further than a reform in Parliament, such as that which was accomplished less than thirty years after his death. He had no desire to see changed the constitution of the kingdom as vested in King, Lords and Commons.

"He used frequently to say," says his son, "and it was said of him, that though he was an Unitarian in religion he was in that country a Trinitarian in politics. When he came to America he found reason to change his opinions, and he became a decided friend to the general principles and practice of a completely representative Government, founded upon universal suffrage, and excluding hereditary privileges, as it exists in this country. This change was naturally produced by observing the ease and happiness with which the people lived, and the unexampled prosperity of the country."

But in his feelings he was still an Englishman. He never was naturalised, saying that as he had been born and had lived an Englishman he would die one, let what might be the consequence.

Towards the end of 1797 his new library and laboratory were finished, his books once more arranged and much of his old apparatus installed. He found workmen in Northumberland who could repair his instruments and make such new ones as he wanted. He was thus able to resume the kind of life he led at Birmingham, spending much of the day in the laboratory or alternately

in his study, sometimes engaged on experimental philosophy, at other times in the composition of the theological works which seemed to flow in an unending stream from his pen. He delighted to walk in his garden and to view the beautiful prospect it afforded him of the river and the distant landscape. He had, too, a kindly interest in the whole community, and noted with pleasure the many little improvements going forward in and about the town. There was no apparent abatement in the vigour of his mind or in the keenness and enthusiasm with which he followed the extraordinary expansion of the science he loved so well during the opening years of the nineteenth century. In a letter to Humphry Davy, then at the outset of his brilliant career, he says:—

“It gives me peculiar satisfaction that, as I am far advanced in life and cannot expect to do much more, I shall leave so able a fellow-labourer of my own country in the great fields of experimental philosophy. . . . I rejoice that you are so young a man; and perceiving the ardour with which you begin your career I have no doubts of your success.”

The following letter to his old friend Mrs Barbauld, with whom he kept up a correspondence to the last, gives some account of his condition at this time:—

“DEAR MADAM,—This will, I hope, be delivered, as it will be conveyed by my son. How happy should I think myself to wait on you and Mr Barbauld in person. Should there be a *peace*, I do promise myself that pleasure, but at present this great blessing seems to be at a great distance. How many melancholy changes have taken place since I left England, and among these is the death of Dr Enfield, a man at least ten years younger than me, and to appearance more healthy. I am also much alarmed at the accounts I receive of your brother [Dr John Aiken], whom I left in perfect health,

but the last were rather more favourable. His life is of great value, both to his relatives, acquaintances and the world at large, few men having been more usefully employed. I am willing to hope he is yet reserved for more usefulness.

"When I compare the perturbed state of Europe with the quiet of this place I wish all my friends were here, provided they could find sufficient employment to be happy; but if they be like myself they must be content to be idle, except so far as they can make themselves employment in their closets. My library and laboratory sufficiently occupy me, and of common society I have as much as I want. A few more *rational Christians* to form a society would make this place a paradise to me, and this would be wanting in many parts of England.

"It is a pleasure to be in a place that is continually and visibly improving, and this is the case here to an astonishing degree. In every year we find a very sensible difference, and in all probability improvements of all kind will go on more rapidly than ever. Nature has done everything that can be done for any place. Perhaps you have seen the views of it taken by Miss Daich. They are not by any means too flattering.

"Could I have my daughter here I should be happy indeed. But this, I fear, is not likely to be accomplished, owing to the strange obstinacy and prejudice of Mr Finch. Her trials must be very great, but she is naturally cheerful, and has a strong sense of *religion*, which, I hope, will support her. This, sufficiently impressed, will make us equal to everything. Your kindness to her affects me much. *A friend in need is a friend indeed.* Something will, I hope, be done for her before my son returns, but what it can be I do not know. Her uncle has some proposal to make to my son in her favour, but the obstinacy of Mr Finch may defeat everything.

"You have obliged me very much by the exquisite little poem you sent me. I hope you will add to the obligation by the communication of the fragment on the 'Game of Chess,' or any other little piece you may think proper to send me. You had no copy of your first poem to my wife, or I should value *that* above any other, and also the little poem you wrote on the birth of Joseph.

"I shall always be very happy to hear from you; and, with my

best respects to Mr Barbauld, I am, dear Madam, yours sincerely,
J. PRIESTLEY.

"NORTHUMBERLAND, Dec. 23, 1798.

"Mrs BARBAULD, Hampstead,
near London."

His son has given us a faithful picture of his closing years and of the serenity of the evening of his life.

"For the last four years of his life he lived under an administration, the principles and practice of which he perfectly approved, and with Mr Jefferson, the head of that administration, he frequently corresponded, and they had for each other a mutual regard and esteem. He enjoyed the esteem of the wisest and best men in the country, particularly at Philadelphia, where his religion and his politics did not prevent his being kindly and cheerfully received by great numbers of opposite opinions in both, who thus paid homage to his knowledge and virtue."

In 1800 he put together his last scientific work, and the one which he regarded as the crown of all his efforts, viz., his *Doctrine of Phlogiston Established*. It can never be said of Priestley that he was to one thing constant never: versatile as he was, and with an extraordinary capacity for adaptation and change in matters of philosophy and theological doctrine, he was ever constant to phlogiston.

During the spring of 1801, whilst on a visit to Philadelphia, he had an attack of fever from which he never wholly recovered. It left him predisposed to the fever and ague at that time prevalent at Northumberland and he had a succession of attacks which weakened him greatly. Nevertheless, his spirits were uniformly good and his complacency and cheerfulness of manner never left him; and although he was incapable of taking much physical exercise and had to give up working in his garden, he spent a considerable amount of time in his

laboratory, experimenting with all the enthusiasm and eagerness of his most active period with the newly-discovered pile of Volta, and sending his results to *Nicholson's Journal*.

In 1802 he was enabled to send his *Church History* to press, owing to the action of his friends in England, who, unknown to him, had set a subscription on foot sufficient to cover the expense of publication.

Although he was obviously failing in strength, owing to gastric troubles, he continued to work on either in his study or in his laboratory. He sent a couple of papers to the American Philosophical Society on scientific subjects, and he published an essay on *Jesus and Socrates Compared*. In the November of 1803 it was evident that his end was approaching. Still he struggled on, hoping by careful attention to his diet he might still see the spring. He told the physician who attended him that if he could but patch him up for six months longer he should be perfectly satisfied, as he should in that time be able to complete the printing of his works. So precarious did he consider his life that he took the precaution of transcribing one day in long-hand what he had composed the day before in short-hand, that he might by that means leave the work complete as far as it went should he not live to finish the whole.

With the beginning of 1804 his weakness had greatly increased. In his diary for January 31 he notes:—"Ill all day—not able to speak for nearly three hours." Still he rose, dressed and shaved himself (which he never omitted doing every morning till within two days of his death), went to his laboratory and lit his fire, but found his weakness so great that he was obliged to get

back to his study. During the next and following days he was better, and was able to see to the correction of his proof-sheets, but on February 4 he took to his bed, although he was able to read and look over a sheet of proof and to check the Greek and Hebrew quotations.

“In the course of the day,” says his son, “he expressed his gratitude in being permitted to die quietly in his family, without pain, with every convenience and comfort he could wish for. He dwelt upon the peculiarly happy situation in which it had pleased the Divine Being to place him in life, and the great advantage he had enjoyed in the acquaintance and friendship of some of the best and wisest men in the age in which he lived, and the satisfaction he derived from having led a useful as well as a happy life.”

In the evening he had his grandchildren brought to his bedside, saying it gave him great pleasure to see the little things kneel. After prayers they wished him a good-night and he gave each his blessing, exhorting them all to continue to love each other.

“And you, little thing,” speaking to the youngest, “remember the hymn you learned : ‘Birds in their little nests agree.’ I am going to sleep as well as you ; for death is only a good long sleep in the grave, and we shall meet again.”

He lingered through the night, and in the early morning requested his son to take down some additions and alterations he wished inserted in his proofs, dictating as clearly and distinctly as he had ever done in his life. When these were read to him he said, “That is right ; I have now done.” Shortly afterwards he put his hand to his face and breathed his last so easy that those who were sitting close to him hardly perceived he had passed away.

What was mortal of him now rests in a little hill-side

cemetery overlooking the beautiful river. The spot is marked with a simple headstone on which is engraven—

To

THE MEMORY OF THE
REV. DR JOSEPH PRIESTLEY,

WHO DEPARTED THIS LIFE
ON THE 6TH FEBY. 1804.

ANNO. ÆTATIS LXXI.

“ Return unto thy rest, O my soul, for the
Lord hath dealt bountifully with thee.
I will lay me down in peace and sleep till
I awake in the morning of the resurrection.”



CHAPTER XI

Priestley as a man of science—His characteristics as a philosopher—*Experiments and Observations on Different Kinds of Air*—His discovery of the influence of vegetation on vitiated air—Atmospheric air not elementary—His researches on nitric oxide—Eudiometry—Nitrous oxide—Discovers hydrogen chloride—Prepares oxygen from nitre (1771)—Isolates ammonia gas—Discovers sulphur dioxide—Dephlogisticated air (oxygen)—Discovers silicon fluoride—Intra-diffusion of gases—Respiration—Priestley's opinions of the value of experimental science in education—Discovers nitrosulphuric acid—Notes the constancy of composition of the atmosphere—Prepares chlorine—Sound in "air"—Experiments relating to phlogiston—The seeming conversion of water into air—Watt and the compound nature of water—Discovers sulphuretted hydrogen—Priestley's confession of faith in phlogiston.

PRIESTLEY'S position in the history of science mainly rests on his discoveries in pneumatic chemistry. The course of inquiry which he began at Leeds was continued by him, with characteristic assiduity and conspicuous success, at Calne, and his labours added largely to the number of the aeriform bodies which were clearly recognised as distinct substances, essentially differing from each other, and not merely modifications of a common principle, modified or affected by properties more or less fortuitous and accidental. The old idea of the nature of "air" had its origin in the doctrine of the Four Elements. It is Priestley's merit that he, more than any man of his time, contributed to the overthrow of this conception as the basis of a philosophical system of the constitution of the material universe.

Although Priestley could not be unmindful that his claim to scientific fame was to be found in the succession of volumes which he called *Experiments and Observations on Different Kinds of Air*, the very title suggests that he, at all events in the outset, was hardly conscious of the magnitude and true significance of his work. Priestley was in no real sense a speculative philosopher: he was indeed pre-eminently the type of man whom Hobbes disparaged as an "experimentarian philosopher," and an experimentarian philosopher he remained to the end of his days. He was aware of his limitations, and many passages from his works, and especially from his correspondence, might be quoted in proof of this fact. His simple, unaffected candour was indeed one of the charms of his character and the secret of much of his influence. It is reflected in every page of his scientific writings. His own discoveries, taken collectively, did more than those of any one of his contemporaries to uproot and destroy the only generalisation by which his immediate predecessors had sought to group and connect the phenomena of chemistry, but he was wholly unable to perceive this fact. A patient and industrious observer, absolutely truthful, and, as he hoped and believed, unbiassed and impartial, he was nevertheless entirely lacking in the higher qualities of the imagination or in that power of divination which is the characteristic of men of the type of Newton. The contrast between Priestley—the social, political and theological reformer, always in advance of his times, receptive, fearless and insistent; and Priestley the man of science—timorous and halting when he might well be bold, conservative and orthodox when almost every other active worker was heterodox and progressive—is most striking. And

yet, such is the irony of circumstance, Priestley's name mainly lives as that of a chemical philosopher. When men have desired to do him honour, and have sought to perpetuate his memory by statues in public places, he is generally represented as making a chemical experiment. In reality, great as Priestley's merit is as an experimental philosopher, his greater claim on our regard and esteem rests upon his struggles and his sufferings in the cause of civil, political and religious liberty.

The years which Priestley spent at Calne constitute the most fruitful period of his scientific career. Practically all that he did in the way of solid achievement and of addition to the armoury of science was effected during that time. Although, after leaving Lord Shelburne, he continued to pursue scientific inquiry with his wonted zeal and industry, doubtless adding thereby to his fame among his contemporaries, posterity has set the true measure of appreciation to his later efforts. He doubtless made many hundreds of experiments in connection with more or less well-defined trains of inquiry; nevertheless, it cannot be maintained that during his subsequent period he added many first-rate facts to our knowledge, or indeed discovered any facts at all comparable in importance with those he ascertained during his life in Wiltshire. On the contrary, what he did observe—as for example the seeming conversion of water into air—too frequently led him astray and was the cause of error to himself and others. Thus Watt's claim to be considered as an independent, if not the first and true, discoverer of the real chemical nature of water is based upon Priestley's experimental blunders. Watt was undoubtedly accurate in his surmise, but the surmise was right in spite of, and

not by reason of, Priestley's experimental evidence. Priestley recorded his experiments with such fulness that it is now easy to perceive where he went wrong. He was constantly on the verge of a discovery, sometimes indeed of a discovery of cardinal importance, but as constantly it eluded his grasp. The experiments on the seeming conversion of water into air might have led him, when he got over his chagrin on the detection of the real cause of his error, to the recognition of the underlying truth in it, namely, the principle of the diffusion of gases. He was, of course, familiar with the fact that the various gases he discovered, or which were known to him, differed in relative density, and he knew perfectly well that they tended to escape from the bottles in which they were contained if these were uncovered and freely exposed to the air. But, so far as we can learn, he never seems to have pondered on these facts, or noted their connection with the phenomena he observed in the course of his many experiments with Wedgwood's retorts, and of the interchange of the water vapour he introduced into them with the gases of the fire which heated them. And yet, had he perceived even a glimmer of the truth he had sufficient means at his disposal, and sufficient knowledge from his own work and that of his contemporaries, to make the great step which it was reserved to Graham to accomplish half a century later.

Whilst the chief importance of the *Experiments and Observations on Different Kinds of Air* is that it is Priestley's *magnum opus*, to his biographer it has the additional interest of affording an insight into the personal character and intellectual attributes of its author. Few writers on scientific subjects have ever

taken their readers so completely into their confidence as Priestley. Whatever he knows or thinks he tells : doubts, perplexities, blunders are set down with the most refreshing candour ; one forgives the prolixity and occasional tediousness, even the little touches of self-satisfaction, in view of the transparent honesty of purpose, the single-minded pursuit of truth for its own sake, wholly apart from preconception or bias of dogma which shine on every page. As key-notes to character, even the dedications and prefaces to the several volumes have their peculiar value and charm, as evidence of the workings of an ingenuous mind.

The publication of the six volumes comprising the original work—the edition of greatest value to Priestley's biographer—extended from 1775 to 1786. Although the space at our disposal precludes any attempt at a full account of the contents, it is necessary to set these out in such detail as may serve to afford a just idea of their value, and with such comment as may be necessary to elucidate their significance.

In the preface to the first volume, which made its appearance in 1775, with a dedication to Lord Shelburne, Priestley thinks it necessary to explain why he has decided, contrary to his original intention, but with the approbation of the President and of his friends in the Royal Society, not to send them any more papers on the subject of "Air" at present but to make immediate publication of all he has done with respect to it. In view, he says, of the rapid progress that has been made and may be expected to be made in this branch of knowledge, "unnecessary delays in the publication of experiments relating to it are peculiarly unjustifiable."

“When, for the sake of a little more reputation, men can keep brooding over a new fact, in the discovery of which they might possibly have very little real merit, till they think they can astonish the world with a system as complete as it is new, and give mankind a prodigious idea of their judgment and penetration, they are justly punished for their ingratitude to the fountain of all knowledge, and for the want of a genuine love of science and of mankind in finding their boasted discoveries anticipated and the field of honest fame pre-occupied by men who, from a natural ardour of mind, engage in philosophical pursuits, and with an ingenuous simplicity immediately communicate to others whatever occurs to them in their inquiries.”

Priestley's productions, from the very nature of the case make no pretensions to completeness.

“In completing one discovery we never fail to get an imperfect knowledge of others of which we could have no idea before, so that we cannot solve one doubt without creating several new ones.”

He farther observes that a person who means to serve the cause of science effectually must hazard his own reputation so far as to risk even *mistakes* in things of less moment.

“Among a multiplicity of new objects and new relations some will necessarily pass without sufficient attention; but if a man be not mistaken in the principal objects of his pursuits he has no occasion to distress himself about lesser things.

“In the progress of his inquiries he will generally be able to rectify his own mistakes; or if little and envious souls should take a malignant pleasure in detecting them for him and endeavouring to expose him, he is not worthy of the name of a philosopher if he has not strength of mind sufficient to enable him not to be disturbed at it. He who does not foolishly affect to be above the failings of humanity will not be mortified when it is proved that he is but a man.”

He made it a rule to disclose the real views with which he made his experiments. Although, he says,

by following a contrary maxim he might have acquired a character of greater sagacity, he thought that two good ends were secured by his method—one as tending to make his narrative more interesting, and the other as encouraging other adventurers in experimental philosophy by showing them that by pursuing even false lights real and important truths may be discovered, and that in seeking one thing we often find another. He believes, however, that he writes more concisely than is usual with those who publish accounts of their experiments, and in thus refraining from swelling his book "to a pompous and respectable size" he trusts he will earn the gratitude of those philosophers who, having but little time to spare for *reading*, which is always the case with those who *do* much themselves, will thereby be kept not too long from their own pursuits. He then comments on what he justly considers the amazing improvements in natural knowledge which have been made within the century, and contrasts these with the comparative poverty as regards scientific results of the many preceding ages, which yet abounded with men who had no other object but study; and he rejoices to think that this rapid progress of knowledge, extending itself not this way or that way only, but in all directions, will be the means of extirpating all error and prejudice and of putting an end to all undue and usurped authority in the business of religion as well as of science.

"It was ill policy in Leo the Tenth to patronise polite literature. He was cherishing an enemy in disguise. And the English hierarchy (if there be anything unsound in its constitution) has equal reason to tremble even at an air-pump or an electrical machine."

He regrets that the rich and great in this country, un-

mindful of the example of Bacon, give less attention to these matters than do men of rank and fortune in other countries : he contrasts the pleasure of the pursuit of science with the pains and penalties of the pursuit of politics.

“ If extensive and lasting fame be at all an object, literary, and especially scientific, pursuits are preferable to political ones in a variety of respects. . . . If extensive usefulness be the object, science has the same advantage over politics. The greatest success in the latter seldom extends farther than one particular country and one particular age, whereas a successful pursuit of science makes a man the benefactor of all mankind and of every age. How trifling is the fame of any statesman that this country has ever produced to that of Lord Bacon, of Newton, or of Boyle ; and how much greater are our obligations to such men as these than to any other in the whole *Biographia Britannica*.”

It would be interesting to know the sentiments of Lord Shelburne, then in the cold shade of retirement, as he perused these passages, and whether he realised the truth of the little homily from his “ tame philosopher.”

The preface is followed by an introduction, in which Priestley gives a rapid and confessedly imperfect survey of the state of knowledge concerning “ air ” prior to 1774. He gives to Boyle the credit of first clearly recognising that elastic fluids exist differing essentially from the air of the atmosphere, but agreeing with it in the properties of weight, elasticity and transparency. But he also points out that two remarkable kinds of factitious air had long been known to miners, viz., *choke damp*, which is heavier than air, which lies at the bottom of pits, extinguishes flame and kills animals ; and the other, called *fire damp*, which is lighter than common air, is found, therefore, near the roofs of sub-

terraneous places and is liable to take fire and explode like gunpowder. "The word *damp* signifies *vapour* or *exhalation* in the German and Saxon languages."

"Air of the former kind, besides having been discovered in various caverns, particularly the Grotta del Cane in Italy, had also been observed on the surface of fermenting liquors, and had been called *gas* (which is the same with *geist*, or *spirit*) by Van Helmont and other German chemists; but afterwards it obtained the name of *fixed air*, especially after it had been discovered by Dr Black of Edinburgh to exist, in a fixed state, in alkaline salts, chalk, and other calcareous substances."

Black's work is dealt with in half a dozen lines, and a passing reference is made to Macbride and Brownrigg. A very imperfect account is given of the work of Hales, although it is stated that "his experiments are so numerous and various that they are justly esteemed to be the solid foundation of all our knowledge of this subject." This section concludes with the mention of Cavendish's determinations of the relative weights of fixed air (carbon dioxide), and inflammable air from metals (hydrogen), and of Lane's observations that water charged with carbonic acid will dissolve iron, "and thereby become a strong chalybeate."

Priestley was the last man in the world to seek to disparage the work of his predecessors or to minimise what was due to them. In reality he had the intention, as he distinctly states, to write at his leisure the history and present state of discoveries relating to air, in a manner similar to his *History of Electricity*, and of the *Discoveries Relating to Vision, Light and Colours*, when no doubt he would have done full justice to all concerned. In the meantime he gives only such particulars as are necessary, in his judgment, to the understanding of his own work.

The remaining section of the introduction deals with

his method of experimenting and with the apparatus he employed. It is of historical interest as containing a description of that most useful article of chemical furniture, his well-known pneumatic trough. He explains its use and gives details of his modes of manipulation. What an advance these were in simplicity, ingenuity and convenience can only be fully realised by comparing his methods with those of Hales. Not the least of Priestley's services to science were the improvements he effected in that section of operative chemistry which is concerned with the preparation, collection and storage of gaseous substances.

The main body of the volume is divided into two parts—the first dealing with observations made in and before 1772, the second with observations made in the year 1773 and in the beginning of 1774. In the outset Priestley finds himself at a disadvantage in regard to the only terms at that time in vogue for the factitious airs, viz., *fixed*, *mephitic* and *inflammable*, which, he rightly says, are not sufficiently characteristic and distinct. Strictly speaking, any two of these terms might be applied to any one of the "airs" then known. The inflammable air from metals, as well as choke damp, is noxious, and therefore mephitic, as is fixed air, and since the inflammable airs are, apparently, capable of being imbibed by certain substances they may equally be considered fixable. The term *fixed air* had, however, acquired a distinctive meaning, and rather than introduce a new term or change the signification of an old one, he would, with his contemporaries, restrict the term to the air which had been made the subject of Black's memorable investigation. The first paper in this section deals with fixed air; it is practically a reprint of that in the

Phil. Trans. and which has already been described in sufficient detail. In the course of his experiments he says he once thought that the readiest method of procuring fixed air, and in sufficient purity, would be to heat pounded lime-stone in a gun barrel, "making it pass through the stem of a tobacco pipe or a glass tube carefully luted to the orifice of it."

"In this manner I found that air is produced in great plenty ; but, upon examining it, I found to my great surprise that little more than one half of it was fixed air, capable of being absorbed by water ; and that the rest was inflammable, sometimes very weakly, but sometimes pretty highly so."

He surmised that this "air" must come from the iron, and yet, he noted, it differed from the ordinary inflammable air from iron by the remarkable blue colour of its flame, and he concludes that "this inflammable principle may come from some remains of the animals from which it is thought that all calcareous matter proceeds." Priestley, we now know, had incidentally converted some of the fixed air into the only other oxide of carbon, but he failed to appreciate the significance of his observation, and the credit of the discovery of carbon monoxide belongs to Cruikshank.

In his next paper on "Air in which Candles have burned," Priestley made a discovery of the very highest importance. He had attempted to verify without success the allegation by the Count de Saluce, made in the memoirs of the Philosophical Society of Turin, that air vitiated by the combustion of candles could be restored by exposure to cold.

"Though this experiment failed," he says, "I have been so happy as by accident to have hit upon a method of restoring air which has been injured by the burning of candles, and to

have discovered at least one of the restoratives which Nature employs for this purpose. It is *vegetation*. This restoration of vitiated air, I conjecture, is effected by plants imbibing the phlogistic matter with which it is overloaded by the burning of inflammable bodies. But whether there be any foundation for this conjecture or not, the fact is, I think, indisputable."

He then proceeds to give an account of his observations on the growing of plants in confined air which led to his discovery.

"One might have imagined," he says, "that since common air is necessary to vegetable as well as to animal life, both plants and animals had affected it in the same manner; and I own I had that expectation when I first put a sprig of mint into a glass jar standing inverted in a vessel of water: but when it had continued there for some months I found the air would neither extinguish the candle, nor was it at all inconvenient to a mouse, which I put into it. . . . Finding that candles would burn very well in air in which plants had grown a long time, and having had some reason to think that there was something attending vegetation which restored air that had been injured by respiration, I thought it was possible that the same process might also restore the air that had been injured by the burning of candles.

"Accordingly, on the 17th of August 1771, I put a sprig of mint into a quantity of air in which a wax candle had burned out, and found that on the 27th of the same month another candle burned perfectly well in it. This experiment I repeated, without the least variation in the event, not less than eight or ten times in the remainder of the summer.

"Several times I divided the quantity of air in which the candle had burned out into two parts, and putting the plant into one of them left the other in the same exposure, contained also in a glass vessel immersed in water, but without any plant, and never failed to find that a candle would burn in the former but not in the latter. . . . This remarkable effect does not depend upon anything peculiar to *mint*, which was the plant that I always made use of till July 1772; for on the 16th of that month I found a quantity of this kind of air

to be perfectly restored by sprigs of *balm*, which had grown in it from the 7th of the same month.

“That this restoration of air was not owing to any aromatic effluvia of these two plants not only appeared by the *essential oil of mint* having no sensible effect of this kind, but from the equally complete restoration of this vitiated air by the plant called *groundsel*, which is usually ranked among the weeds and has an offensive smell. Besides, the plant which I have found to be the most effectual of any that I have tried for this purpose is *spinach*, which is of quick growth, but will seldom thrive long in water.”

The next paper on “Inflammable Air” is of slight importance, and indeed is full of errors. Priestley made no distinction between the inflammable air obtained by the action of acids on metals (hydrogen) and that formed by the destructive distillation of coal and other organic substances (marsh gas or carbonic oxide, or mixtures of the two), and his inability to distinguish these different gases accounts for many of the phenomena he observed and which he confesses himself unable to explain. The most sagacious observation in the memoir has reference to the colour of the electric spark in the different gases which he accurately describes.

The paper on “Air Infected with Animal Respiration or Putrefaction” may be considered as the complement of that on “Air in which a Candle has burned out,” and is no less valuable.

“That candles will burn only a certain time in a given quantity of air is a fact not better known than it is that animals can live only a certain time in it; but the cause of the death of the animal is not better known than that of the extinction of flame in the same circumstances; and when once any quantity of air has been rendered noxious by animals breathing in it as long as they could, I do not know that any methods have been discovered of rendering it fit for breathing again. It is evident, however, that there must be some

provision in Nature for this purpose, as well as for that of rendering the air fit for sustaining flame ; for without it the whole mass of the atmosphere would, in time, become unfit for the purpose of animal life ; and yet there is no reason to think that it is, at present, at all less fit for respiration than it has ever been. I flatter myself, however, that I have hit upon two of the methods employed by Nature for this great purpose. How many others there may be I cannot tell."

One of these methods he eventually finds to be, as in the first case, the action of vegetation, and he proves by a number of decisive experiments

"that plants, instead of affecting the air in the same manner with animal respiration, reverse the effects of breathing and tend to keep the atmosphere sweet and wholesome when it is become noxious in consequence of animals either living and breathing, or dying and putrefying in it."

The other method he conceived to be the action of water, since he found that by vigorous agitation with water, air which breathing had rendered noxious could again be breathed for a further period.

"I do not think it improbable but that the agitation of the sea and large lakes may be of some use for the purification of the atmosphere, and the putrid matter contained in water may be imbibed by aquatic plants, or be deposited in some other manner."

When a confined volume of common air is placed in contact with a mixture of iron filings and sulphur made into a paste with water, a certain portion of the air is imbibed by the paste. This fact was first observed by Hales. Priestley repeated the observation and found that about a fifth or rather more of the volume of the air was thus absorbed. He noted that the residual "air" was rather lighter than common air, it had no action on lime-water and was exceedingly noxious to animals, by which is meant that it could not

be breathed by them. Priestley had thus prepared nitrogen, but he failed to recognise the individuality of this gas.

In his *Statical Essays* Hales makes mention of an experiment in which common air and air generated from pyrites by spirit of nitre made a turbid red mixture, and in which part of the common air was absorbed. This phenomenon "particularly struck" Priestley, who, acting upon Cavendish's hint that the red appearance was probably dependent "upon the spirit of nitre only" and that the metals might answer as well as pyrites, proceeded to investigate the action of nitric acid upon a number of the metals, and as the result of his inquiries he succeeded in isolating the gas we now know as *nitric oxide*, but which he termed *nitrous air*.

"Though," he says, "I cannot say that I altogether like the term, neither myself nor any of my friends, to whom I have applied for the purpose, have been able to hit upon a better."

This paper exhibits Priestley at his best. In it he describes all the main properties of nitric oxide.

"One of the most conspicuous properties of this kind of air," he says, "is the great diminution of any quantity of common air with which it is mixed, attended with a turbid red, or deep orange colour, and a considerable heat. . . . The diminution of a mixture of this and common air is not an equal diminution of both the kinds, which is all that Dr Hales could observe, but of about one fifth of the common air, and as much of the nitrous air as is necessary to produce that effect; which, as I have found by many trials, is about one half as much as the original quantity of common air.

"I hardly know any experiment that is more adapted to amaze and surprise than this is, which exhibits a quantity of air which, as it were, devours a quantity of another kind of air half as large as itself, and yet is so far from gaining any

addition to its bulk that^o it is considerably diminished by it. . . .

"It is exceedingly remarkable that this effervescence and diminution, occasioned by the mixture of nitrous air, is peculiar to common air, or *air fit for respiration*, and, as far as I can judge from a great number of observations, is at least very nearly, if not exactly, in proportion to its fitness for this purpose; so that by this means the goodness of air may be distinguished much more accurately than it can be done by putting mice or any other animals to breathe in it.

"This was a most agreeable discovery to me, as I hope it may be a useful one to the public; especially as from this time I had no occasion for so large a stock of mice as I had been used to keep for the purpose of these experiments."

Priestley here suggests the basis of a method of *Eudiometry*, or method of measuring the goodness of air, which in his hands, but more especially in those of Cavendish, led to most important results. The quantitative analysis of the air may be said to have taken its rise from the publication of Priestley's paper.

In the course of subsequent work on nitrous air Priestley had occasion to study its action on iron, whereby he says:—

"A most remarkable and most unexpected change was made in the nitrous air," the iron "makes it not only to admit a candle to burn in it, but enables it to burn with an *enlarged flame*. . . . Sometimes I have perceived the flame of the candle, in these circumstances, to be twice as large as it is naturally, and sometimes not less than five or six times larger; and yet without anything like an *explosion*, as in the firing of the weakest inflammable air."

Priestley in this manner obtained *nitrous oxide*, the properties of which he subsequently studied in some detail.

In the paper which follows, *viz.*, "On Air infected with the Fumes of Burning Charcoal," he incidentally gains

further insight into the nature of atmospheric air. By what he called throwing the focus of a burning mirror on charcoal suspended in air contained in a glass tube standing over water or mercury—a favourite method of his when he had occasion to heat a substance in a gas—he could observe the phenomena with great precision. He noticed the formation of the fixed air and determined the degree of diminution when the burning took place over water or over lime-water.

“In this manner,” he says, “I diminished a given quantity of air one-fifth. Air thus diminished by the fumes of burning charcoal not only extinguishes flame, but is in the highest degree noxious to animals; it makes no effervescence with nitrous air, and is incapable of being diminished any farther by the fumes of more charcoal. . . . All my observations show that air which has once been fully diminished . . . is not only incapable of any further diminution . . . but that it has likewise acquired *new properties*, most remarkably different from those which it had before. . . .”

By heating pieces of lead and tin in air by means of a burning glass he observed the formation of a metallic calx, the volume of air was diminished, and it also “was in the highest degree noxious and made no effervescence with nitrous air.”

The real significance of these phenomena was, however, wholly unperceived by Priestley, and phlogiston, as usual, led him astray. He had, of course, in all these experiments prepared *nitrogen*, and in a state of sensible purity. He imagined, however, that he had simply “phlogisticated” the air, the phlogiston coming from the charcoal and the metals, and that this phlogisticated air was imbibed by the water.

An experiment described by Cavendish led Priestley to study the action of “Spirit of Salt” (hydrochloric acid)

upon copper. As Cavendish had already stated, the gas so evolved "lost its electricity by coming into contact with water." By collecting the gas over mercury Priestley was able to study its properties more exactly. From certain anomalies in the experiments he says :—

"I concluded that this subtle air did not arise from the copper, but from the spirit of salt; and presently making the experiment with the acid only, without any copper, or metal of any kind, this air was immediately produced in as great plenty as before; so that this remarkable kind of air is, in fact, nothing more than the vapour, or fumes of spirit of salt, which appear to be of such a nature that they are not liable to be condensed by cold, like the vapour of water and other fluids, and therefore may be very properly called an *acid air*, or more restrictively the *marine acid air*."

The new gas discovered by Priestley we now call hydrogen chloride. Ordinary hydrochloric acid is simply an aqueous solution of it.

"Water impregnated with it makes the strongest spirit of salt that I have seen, dissolving iron with the most rapidity. . . . Iron filings, being admitted to this air, were dissolved by it pretty fast, half of the air disappearing and the other half becoming inflammable air, not absorbed by water. Putting chalk to it, fixed air was produced."

He subsequently found that the marine acid air was more conveniently made by the action of oil of vitriol upon common salt.

From the "miscellaneous observations" with which this section of the volume concludes, there can be little doubt that Priestley, without knowing it, had prepared oxygen gas from nitre as far back as 1771. The accounts he gives of the behaviour of the gas obtained by heating nitre in a gun-barrel plainly indicate this fact.

“A candle,” he says, “not only burned but the flame was increased, and something was heard like a hissing similar to the decrepitation of nitre in an open fire. He also noted the effect of nitrous air upon it and concludes that “this series of facts relating to air extracted from nitre appear to me to be very extraordinary and important, and in able hands may lead to considerable discoveries.”

The second section of the volume deals with experiments and observations made in 1773 and the beginning of 1774, and opens with an account of the discovery of *ammonia* gas.

“After I had made the discovery of the *marine acid air*, which the vapour of spirit of salt may properly enough be called . . . it occurred to me that by a process similar to that by which this *acid* air is expelled from the spirit of salt an *alkaline* air might be expelled from substances containing volatile alkali.

“Accordingly I procured some volatile spirit of sal ammoniac, and having put it into a thin phial, and heated it with the flame of a candle, I presently found that a great quantity of vapour was discharged from it; and being received in a vessel of quicksilver, standing in a basin of quicksilver, it continued in the form of a transparent and permanent air, not at all condensed by cold; so that I had the same opportunity of making experiments upon it as I had before on the acid air, being in the same favourable circumstances. . . . Wanting, however, to procure this air in greater quantities, and this method being rather expensive, it occurred to me that alkaline air might probably be procured, with the most ease and convenience, from the original materials, mixed in the same proportions that chemists had found by experience to answer the best for the production of the volatile spirit of sal ammoniac. Accordingly I mixed one-fourth of pounded sal ammoniac with three-fourths of slaked lime; and filling a phial with the mixture, I presently found it completely answered my purpose. The heat of a candle expelled from this mixture a prodigious quantity of alkaline air; and the same materials . . . would serve me a considerable time without changing. . . .”

He next studied the properties of the alkaline air. He found, of course, it was readily soluble in water.

"Having satisfied myself with respect to the relation that alkaline air bears to water, I was impatient to find what would be the consequence of mixing this new air with the other kinds with which I was acquainted before, and especially with *acid* air; having a notion that these two airs, being of opposite natures, might compose a *neutral air*, and perhaps the very same thing with common air. But the moment that these two kinds of air came into contact a beautiful white cloud was formed, and presently filled the whole vessel in which they were contained. . . . When the cloud was subsided there appeared to be formed a solid *white salt*, which was found to be the common *sal ammoniac*, or the marine acid united to the volatile alkali. . . .

"*Fixed air* admitted to alkaline air formed oblong and slender crystals. . . . These crystals must be the same thing with the volatile alkalis which chemists get in a solid form by the distillation of *sal ammoniac* with fixed alkaline salts. . . .

"Alkaline air, I was surprised to find, is slightly inflammable. . . .

"That alkaline air is lighter than acid air is evident from the appearances that attend the mixture, which are indeed very beautiful. When acid air is introduced into a vessel containing alkaline air, the white cloud which they form appears at the bottom only and ascends gradually. But when the alkaline air is put to the acid the whole becomes immediately cloudy quite to the top of the vessel."

Up to now Priestley had mainly confined himself to the narration of the new *facts* which he had discovered, barely mentioning any *hypotheses* that occurred to him.

"The reason why I was so much upon my guard in this respect was lest, in consequence of attaching myself to any hypothesis too soon, the success of my future inquiries might be obstructed. But subsequent experiments having thrown great light upon the preceding ones, and having confirmed the few conjectures I then advanced, I may now venture to speak of my hypotheses with a little less diffidence. Still, however,

I shall be ready to relinquish any notions I may now entertain if new facts should hereafter appear not to favour them."

In a paper on "Common Air Diminished and made Noxious by Various Processes" he attempts to apply the current doctrine of phlogiston to account for the various phenomena he has observed, and with what success may be inferred from his conclusion

"that in the precipitation of lime by breathing into lime-water, the fixed air, which incorporates with lime, comes not from the lungs but from the common air, decomposed by the phlogiston exhaled from them, and discharged, after having been taken in with the aliment, and having performed its function in the animal system."

Priestley's attempts at theorising brought little satisfaction to him or to his readers. Indeed he says :—

"I begin to be apprehensive lest, after being considered as a *dry experimenter*, I should pass into the opposite character of a *visionary theorist*. . . . In extenuation of my offence let it, however, be considered that *theory and experiments* necessarily go hand-in-hand, every process being intended to ascertain some particular *hypothesis*, which, in fact, is only a conjecture concerning the circumstances or the cause of some natural operation ; consequently that the boldest and most original experimenters are those who, giving free scope to their imaginations, admit the combination of the most distant ideas ; and that though many of these associations of ideas will be wild and chimerical, yet that others will have the chance of giving rise to the greatest and most capital discoveries, such as very cautious, timid, sober and slow-thinking people would never have come at.

"Sir Isaac Newton himself, notwithstanding the great advantage which he derived from a habit of *patient thinking*, indulged bold and eccentric thoughts, of which his queries at the end of his book of Optics are a sufficient evidence. And a quick conception of distant analogies, which is the great key to unlock the secrets of Nature, is by no means incompatible

with the spirit of *perseverance* in investigations calculated to ascertain and pursue those analogies."

After this *apologia*, Priestley gives the reins to his imagination, or rather he allows phlogiston to drive the halting, ambling thing for him, with the result that he utterly loses his way and is eventually landed into an impassable quagmire. It is not too much to say that not one of the "Queries, Speculations and Hints" with which the volume closes has stood the test of time.

The second volume, which made its appearance towards the end of 1775, is dedicated to Sir John Pringle, at that time President of the Royal Society. It opens, as usual, with a somewhat prolix but characteristic preface. But to his biographer Priestley's prefaces are not the least interesting or valuable of his literary productions.

"In a preface," he says, "authors have always claimed a right of saying whatever they pleased concerning themselves, and not to lose this right it must now and then be exercised."

In this respect Priestley has championed the prerogatives of authors for all time. This particular preface begins with an expression of self-laudation for the little delay the writer made in putting the first volume to the press.

"In consequence of this considerable discoveries have been made by people of distant nations; and this branch of science, of which nothing, in a manner, was known till very lately, indeed now bids fair to be farther advanced than any other in the whole compass of natural philosophy. . . . And it will not now be thought very assuming to say that by working in a tub of water or a basin of quicksilver we may perhaps discover principles of more extensive influence than even that of *gravity* itself, the discovery of which, in its full extent, contributed so much to immortalise the name of Newton.

“Having been the means of bringing so many champions into the field, I shall, with peculiar pleasure, attend to all their achievements, in order to prepare myself, as I promised in the preface to my last volume, for writing the *history* of the campaign.”

After a delightfully *naïve* compliment to his own ability as an accumulator of facts, and to his merits as an “instrument in the hands of Divine Providence . . . concerning which I threw out some further hints in my former preface, which the excellent French translator was not permitted to insert in his version,” he advances this testimony to his impartiality as an historian:—

“I even think that I may flatter myself so much, if it be any flattery, as to say that there is not, in the whole compass of philosophical writing, a history of experiments so truly *ingenuous* as mine, and especially the section on the discovery of dephlogisticated air, which I will venture to exhibit as a model of the kind. I am not conscious to myself of having concealed the least hint that was suggested to me by any person whatever, any kind of assistance that has been given me, or any views or hypotheses by which the experiments were directed, whether they were verified by the result or not.”

There is much else in the preface that might be quoted as illustrative of the character and mental attributes of its author. Priestley, the natural philosopher, never forgot that he was a minister of religion, and that to him theology was the greatest and most important of all the sciences, and he cannot forbear even, in what he intended to be a scientific disquisition on purely natural phenomena, from inculcating his belief in the divine origin of Christianity and his opinion concerning the doctrine of purgatory and the worship of the dead.

The first chapter is concerned with the discovery of what its author called *Vitriolic Acid Air*, but which we now know as sulphur dioxide.

Priestley imagined that as the liquid marine acid—that is hydrochloric acid—readily yielded an “air” on heating it might be that vitriolic acid, or oil of vitriol, would also afford a characteristic “air” when treated in a similar manner. Acting upon a suggestion of Mr Lane he heated oil of vitriol with olive oil, when he readily obtained a new species of air, which he collected over mercury as he “had been used to do it with the marine acid air; and the whole process was as pleasing and as elegant.” Priestley at once surmised that the olive oil worked by transferring its phlogiston to the vitriolic acid, and he naturally concluded that any substance rich in phlogiston would bring about the same result. He next tried charcoal.

“I put some bits of charcoal into my phial instead of the oil or other inflammable matter which I had used before, and applying the flame of a candle I presently found that the vitriolic acid air was produced as well as in the former process, and in several respects more conveniently, the production of air being equable, whereby the disagreeable effect of a sudden explosion is avoided. . . . Finding that a great variety of substances containing phlogiston enabled the oil of vitriol to throw out a permanent acid air, I had some suspicion that mere *heat* might do the same, but I did not find that there was any foundation for that suspicion. . . . But though I got no air from the oil of vitriol by this process, air was produced at the same time in a manner that I little expected, and I paid pretty dearly for the discovery it occasioned. Despairing to get any air from the longer application of my candles, I withdrew them, but before I could disengage the phial from the vessel of quicksilver a little of it passed through the tube into the hot acid, when instantly it was all filled with dense white fumes, a prodigious quantity of air was generated, the tube through which it was transmitted was broken into many pieces, and part of the hot acid being spilled upon my hand burned it terribly, so that the effect of it is visible to this day. The inside of the phial was coated

with a white saline substance, and the smell that issued from it was extremely suffocating.

“This accident taught me what I am surprised I should not have suspected before, viz., that some *metals* will part with their phlogiston to hot oil of vitriol, and thereby convert it into a permanent elastic air, producing the very same effect with oil, charcoal, or any other inflammable substance.

“Not discouraged by the disagreeable accident above mentioned, the next day I put a little *quicksilver* into the phial with the ground stopple and tube, along with the oil of vitriol, when, long before it was boiling hot, air issued plentifully from it, and being received in a vessel of quicksilver appeared to be genuine vitriolic acid air, exactly like that which I had procured before, being readily imbibed by water and extinguishing a candle in the same manner as the other had done. . . .

“After this I repeated the experiment with several other metals. . . . Copper treated in the same manner yielded air very freely, with about the same degree of heat that quicksilver had required, and the air continued to be generated with very little application of more heat.”

The theory apart, this paper is as important as these on ammonia and the marine acid air, and exhibits Priestley at his best. The observations he makes concerning the main properties of the new gas and its solubility in water, its inability to burn and to support flame, its heaviness, its power to unite with ammonia, to be absorbed by charcoal and to liquefy camphor, are all accurate.

“Having hit upon a method of exhibiting some of the acids in the form of air, nothing could be easier than to extend this process to the rest.”

Accordingly he attempted to procure what he called the *vegetable acid air* by heating “exceedingly strong concentrated acid of vinegar,” and states that he succeeded in obtaining an air which extinguished the flame of a candle and was soluble in water. The paper

is very short and is full of contradictions. In reality, as he subsequently found, he was dealing with vinegar largely adulterated with oil of vitriol. The "vegetable acid air" had no real existence.

The next paper in the series is the most important of the whole, and the one of all others that has contributed most largely to Priestley's reputation. It is entitled "Of Dephlogisticated Air, and of the Constitution of the Atmosphere," and deals with the discovery of oxygen. It begins in the following characteristic fashion :—

"The contents of this section will furnish a very striking illustration of the truth of a remark which I have more than once made in my philosophical writings, and which can hardly be too often repeated, as it tends greatly to encourage philosophical investigations, viz., that more is owing to what we call *chance*—that is, philosophically speaking, to the observation of *events arising from unknown causes* than to any proper *design* or preconceived *theory* in this business. This does not appear in the works of those who write *synthetically* upon these subjects, but would, I doubt not, appear very strikingly in those who are the most celebrated for their philosophical acumen did they write *analytically* and ingenuously,

"For my own part, I will frankly acknowledge that at the commencement of the experiments recited in this section I was so far from having formed any hypothesis that led to the discoveries I made in pursuing them that they would have appeared very improbable to me had I been told of them; and when the decisive facts did at length obtrude themselves upon my notice it was very slowly, and with great hesitation, that I yielded to the evidence of my senses. And yet, when I reconsider the matter, and compare my last discoveries relating to the constitution of the atmosphere with the first, I see the closest and the easiest connection in the world between them, so as to wonder that I should not have been led immediately from the one to the other. That this was not the case I attribute to the force of prejudice which, unknown to ourselves, biases not only our

judgments, properly so called, but even the perceptions of our senses ; for we may take a maxim so strongly for granted that the plainest evidence of sense will not entirely change, and often hardly modify, our persuasions ; and the more ingenious a man is, the more effectually he is entangled in his errors, his ingenuity only helping him to deceive himself by evading the force of truth."

He then points out that there are few maxims in philosophy that have laid firmer hold upon the mind than that air, meaning atmospherical air . . . is a *simple elementary substance*, indestructible and unalterable, at least as much so as water was supposed to be. Priestley, in the course of his inquiries, was soon satisfied that atmospherical air was not an unalterable thing ; that bodies burning in it, and animals breathing it and various other chemical processes, so far alter and deprive it as to render it altogether unfit for the purposes to which it is subservient ; and he had discovered methods, particularly the process of vegetation, which tended to restore it to its original purity.

"But," he says, "I own I had no idea of the possibility of going any further in this way and thereby procuring air purer than the best common air."

As this paper is one of the classics of chemistry, as well as the chief corner-stone in the monument which Priestley erected to himself, it is necessary to examine it, as well as certain other papers which grew immediately out of it, in some degree of detail.

After a reference to a hypothesis of the origin and constitution of the atmosphere which occurs among the "Queries, Speculations and Hints" above referred to, and which is on a par with much in Priestley's speculations, he proceeds to relate the circumstances which more immediately led to the most important of all his dis-

coveries. It was the accident of possessing a burning lens of "considerable force," for want of which he could not possibly make many of the experiments that he had projected.

"But having afterwards procured a lens of twelve inches diameter and twenty inches focal distance, I proceeded with great alacrity to examine, by the help of it, what kind of air a great variety of substances, natural and factitious, would yield, putting them into vessels [short, wide, round-bottomed phials], which I filled with quicksilver and kept inverted in a basin of the same. Mr Warltire, a good chemist, and lecturer in Natural Philosophy, happening to be at that time in Calne, I explained my views to him, and was furnished by him with many substances, which I could not otherwise have procured.

"With this apparatus, after a variety of other experiments, an account of which will be found in its proper place on the 1st August 1774, I endeavoured to extract air from *mercurius calcinatus per se*; ¹ and I presently found that, by means of this lens, air was expelled from it very readily. Having got about three or four times as much as the bulk of my materials, I admitted water to it, and found that it was not imbibed by it. But what surprised me more than I can well express was that a candle burned in this air with a remarkably vigorous flame, very much like that enlarged flame with which a candle burns in nitrous air exposed to iron or liver of sulphur, ² but as I had got nothing like this remarkable appearance from any kind of air besides this particular modification of nitrous air, and I knew no nitrous acid was used in the preparation of *mercurius calcinatus*, I was utterly at a loss how to account for it.

"In this case also, though I did not give sufficient attention to the circumstance at that time, the flame of the candle, besides being larger, burned with more splendour and heat than in that species of nitrous air; and a piece of red-hot wood sparkled in it, exactly like paper dipped in a solution of nitre, and it consumed very fast; an experiment which I had never thought of trying with nitrous air.

¹ Mercuric oxide made by heating quicksilver in air.

² Nitrous oxide: see p. 182.

“ At the same time that I made the above-mentioned experiment I extracted a quantity of air with the very same property from the common *red precipitate*¹ which, being produced by a solution of mercury in spirit of nitre (nitric acid), made me conclude that this peculiar property, being similar to that of the modification of nitrous air above mentioned, depended upon something being communicated to it by the nitrous acid ; and since the *mercurius calcinatus* is produced by exposing mercury to a certain degree of heat, where common air has access to it, I likewise concluded that this substance had collected something of *nitre*, in that state of heat, from the atmosphere.

“ This, however, appearing to me much more extraordinary than it ought to have done, I entertained some suspicion that the *mercurius calcinatus* on which I had made my experiments, being bought at a common apothecary's, might, in fact, be nothing more than red precipitate ; though, had I been anything of a practical chemist, I could not have entertained any such suspicion. However, mentioning this suspicion to Mr Warltire, he furnished me with some that he had kept for a specimen of the preparation, and which, he told me, he could warrant to be genuine. This being treated in the same manner as the former, only by a longer continuance of heat, I extracted much more air from it than from the other.

“ This experiment might have satisfied any moderate sceptic ; but, however, being at Paris in the October following, and knowing that there were several very eminent chemists in that place, I did not omit the opportunity, by means of my friend Mr Magellan, to get an ounce of *mercurius calcinatus* prepared by Mr Cadet, of the genuineness of which there could not possibly be any suspicion ; and at the same time I frequently mentioned my surprise at the kind of air which I had got from this preparation to Mr Lavoisier, Mr le Roy, and several other philosophers, who honoured me with their notice in that city, and who, I daresay, cannot fail to recollect the circumstance.”

This last remark is significant in reference to a claim which was subsequently put forward that the real

¹ Mercuric oxide made by heating mercuric nitrate.

discoverer of oxygen was Lavoisier, and that he obtained it by heating mercuric oxide.¹

Priestley also obtained the same air from *red lead*, which, he says,

“confirmed me more in my suspicion that the *mercurius calcinatus* must get the property of yielding this kind of air from the atmosphere, the process by which that preparation and this of red lead is made being similar. As I never make the least secret of anything that I observe, I mentioned this experiment also, as well as those with the *mercurius calcinatus* and the red precipitate, to all my philosophical acquaintance at Paris and elsewhere, having no idea, at that time, to what these remarkable facts would lead.” [Nitrous oxide.]

Priestley, on his return to England, made an experiment with Cadet’s preparation, which he found to behave precisely like that he had procured from Warltire. He observed that the new gas was only sparingly soluble in water and that its power of causing a candle to burn with a strong flame was in nowise diminished by agitation with water—facts which he said convinced him

“that there must be a very material difference between the constitution of the air from *mercurius calcinatus* and that of phlogisticated nitrous air, [nitrous oxide] notwithstanding their resemblance in some particulars.”

It was not, however, until the following March (1775) (he having meanwhile been intent upon his experiments on the vitriolic air [sulphur dioxide]), that he ascertained the real nature of the new air, and was led “though very gradually . . . to the complete discovery of the constitution of the air we breathe.” By trials with the nitrous air and with mice he found that the new gas was eminently fit for respiration: nitrous air

¹ See the author’s *Essays in Historical Chemistry*—“Priestley, Cavendish, Lavoisier and La Révolution Chimique.”

reduced its volume to a greater extent than in the case of common air, and a mouse lived longer in it than it would in the same volume of common air.

“Thinking of this extraordinary fact upon my pillow, the next morning I put another measure of nitrous air to the same mixture, and to my utter astonishment found that it was farther diminished to almost one-half of its original quantity.”

Priestley now utterly missed his way for a time. He sought to get the new air from the various oxides of lead, but the fetish of phlogiston again led him wrong, and eventually by a train of reasoning which is fully set forth in the paper, but which need not here be repeated, there remained, he says, no doubt in his mind

“but that *atmospherical air*, or the thing that we breathe, *consists of the nitrous acid and earth*, with so much phlogiston as is necessary to its elasticity; and likewise so much more as is required to bring it from its state of perfect purity to the mean condition in which we find it.”

Priestley’s “complete discovery of the constitution of the air we breathe” was thus wholly erroneous: he was very far indeed from having a clear conception of its real nature.

Priestley’s description of the main properties of oxygen is however accurate, and lecturers in chemistry are indebted to him for some striking experimental illustrations of them.

“I easily conjectured,” he says, “that inflammable air would explode with more violence and a louder report by the help of dephlogisticated than of common air; but the effect far exceeded my expectations, and it has never failed to surprise every person before whom I have made the experiment. . . . The dipping of a lighted candle into a jar filled with dephlogisticated air is alone a very beautiful experiment. The strength and vivacity of the flame is striking, and the heat

produced by the flame in these circumstances is also remarkably great. . . . Nothing would be easier than to augment the force of fire to a prodigious degree by blowing it with dephlogisticated air instead of common air. . . . Possibly *platina* might be melted by means of it.

“From the greater strength and vivacity of the flame of a candle, in this pure air, it may be conjectured that it might be peculiarly salutary to the lungs in certain morbid cases. . . . But perhaps we may also infer from these experiments that though pure dephlogisticated air might be very useful as a *medicine*, it might not be so proper for us in the usual healthy state of the body: for, as a candle burns out much faster in dephlogisticated than in common air, so we might, as may be said, *live out too fast*, and the animal powers be too soon exhausted in this pure kind of air. A moralist, at least, may say that the air which Nature has provided for us is as good as we deserve. . . . Who can tell but that, in time, this pure air may become a fashionable article in luxury. Hitherto only two mice and myself have had the privilege of breathing it.”

An experiment which Priestley says “I had the pleasure to see at Paris, in the laboratory of Mr Lavoisier, my excellent fellow-labourer in these inquiries, and to whom, in a variety of respects, the philosophical part of the world has very great obligations,” led him into a train of inquiry upon the action of nitric acid upon a wide range of organic substances, from which however no general results followed, in spite of much experimenting. He had at one time the idea that a fundamental difference existed in the behaviour of animal and vegetable matter with respect to nitric acid, but the observations were contradictory, and although it is readily possible to interpret the phenomena in the light of our present knowledge, they led Priestley to no definite conclusions.

Of more importance is the work on the “Fluor Acid Air”—a substance discovered by “Mr Scheele, a Swede ;

from which circumstance the acid is often distinguished by the name of the *Swedish acid*." Priestley sought to make the air by heating Derbyshire spar (fluor spar) with oil of vitriol in glass vessels,

"as in the process of making spirit of nitre from saltpetre ; and the most remarkable facts that have been observed concerning it are, that the vessels in which the distillation is made are apt to be corroded ; so that holes will be made quite through them ; and that when there is water in the recipient, the surface of it will be covered with a crust of a friable stony matter."

What Priestley actually produced by this method of experimenting was more or less pure *silicon fluoride*, which he proceeded to collect, in his usual fashion, over quicksilver.

"I had no sooner produced this new kind of air but I was eager to see the effect it would have on *water*, and to produce the stony crust formed by their union, as described by Mr Scheele ; and I was not disappointed in my expectations. The moment the water came into contact with this air the surface of it became white and opaque by a *stony film*. . . . Few philosophical experiments exhibit a more pleasing appearance than this, which can only be made by first producing the air confined by quicksilver, and then admitting a large body of water to it. Most persons to whom I have shown the experiment have been exceedingly struck with it. . . . The union of this acid air and water may also be exhibited in another manner, which to some persons makes a still more striking experiment, *viz.*, by admitting the air, as fast as it is generated, to a large body of water resting on quicksilver. . . . It is, then, very pleasing to observe that the moment any bubble of air, after passing through the quicksilver, reaches the water, it is instantly, as it were, converted into a stone ; but continuing hollow for a short space of time, generally rises to the top of the water. . . . I have met with few persons who are soon weary of looking at it ; and some could sit by it almost a whole hour, and be agreeably amused all the time."

Priestley's attempts to explain the real nature of the *fluor acid air* were, as may be expected, not very happy

"These appearances I explain by supposing that the vitriolic acid, in uniting with the spar, is in part volatilised by means of some phlogiston contained in it, so as to form a vitriolic acid air; and there is also combined with this air a portion of the solid earthy part of the spar, which continues in a state of solution till, coming into contact with the water, the fluid unites with the acid, and the earth is precipitated."

The third volume of the work was published in the early part of 1777, with a dedication to Lord Stanhope. It opens, as usual, with the characteristically discursive preface, extending to thirty pages, in which the author apologises for the character of much in the volume. He is constrained to admit that numerous as his *facts* are, "few of them will appear so brilliant in the eye of the *general scholar*" as in either of the two former volumes, although he trusts they will "be thought no less valuable by philosophers and chemists." Priestley, it would seem, was conscious that he was beginning, as the phrase goes, "to write himself out."

"Lest my readers should be alarmed at this addition of one volume after another on the same subject, I do assure them that I shall now certainly give them and myself some respite, and deliver the torch to anyone who may be disposed to carry it, foreseeing that my attention will be sufficiently engaged by speculations of a very different nature. . . . It will be a great satisfaction to me, after the part that I have taken in this business, to be a *spectator* of its future progress, when I see the work in so many and so good hands, and everything in so rapid and so promising a way.

"On taking leave of this subject I would entreat the candour and indulgence of my readers for any oversights they may discover in me as a *philosopher*, or imperfections as a *writer*. I am far from pretending to infallibility; but I have the satisfaction to reflect that, imperfect as my works may be found

to be, they are each as perfect as I was able to make them. . . .

“Upon this, as upon other occasions, I can only repeat that it is not my *opinions* on which I would be understood to lay any stress. Let the *new facts*, from which I deduce them, be considered as my *discoveries*, and let other persons draw better inferences from them if they can. This is a new and a wide field of experiment and speculation, and a premature attachment to hypothesis is the greatest obstruction we are likely to meet with in our progress through it; and as I think I have been pretty much upon my guard myself, I would caution others to be upon their guard too.”

These passages evidently were written under the influence of the feeling of resentment with which he viewed the criticism to which his speculations were subjected abroad. Fontana, Lavoisier and others were, indeed, zealously engaged in using Priestley's own *facts* to destroy the conception by which he explained them. An appeal to the balance was felt to be necessary, and Priestley, as a logician, could not resist it. But he was no quantitative chemist: the habits of a Cavendish were quite foreign to his genius: patient, scrupulous attention to numerical accuracy was not one of his characteristics: he was one of the most industrious of experimenters—delighting, indeed, in manipulation for the mere sake of it, but withal hasty and superficial. It is nowhere evident in his writings that his problems were attacked according to any carefully-thought-out plan. He confesses indeed, on more than one occasion, he tested the inflammability of one of his numerous “airs” *because* he had a lighted candle near him: had the candle not been lighted it would not have occurred to him to do it. Priestley was, in fact, a pioneer: he showed the existence of a new world for science, and he

himself roamed over a portion of it, like a second Joshua; but he had not the experience or the aptitude to accurately map out even that fraction.

There is little in the third volume of permanent value. It is largely an account of a series of disconnected observations on the action of nitric acid upon a variety of substances, which, however, led to no general conclusions. It is, however, certain that if Priestley could have induced himself to follow up certain of his observations he would have arrived at *facts* of far greater importance than those he actually narrates. "*Speculation*," he said, by way of rejoinder to Lavoisier, "is a cheap commodity. *New and important facts* are most wanted, and therefore of most value," and the new and important facts were within his grasp if he had only reached out for them.

Another portion of the work is concerned with supplementary observations on the gases treated of in the preceding volumes, partly by way of correction and partly additional. Here and there we have a suggestive passage, as in the paper on "Experiments on the Mixture of Different Kinds of Air that have no Mutual Action," in which he thus clearly indicates the principle of the intra-diffusion of gases.

"The result of my trials has been this general conclusion: that when two kinds of air have been mixed it is not possible to separate them again by any method of *decanting* or pouring them off, though the greatest possible care be taken in doing it. They may not properly *incorporate*, so as to form a *third species of air*, possessed of new properties; but they will remain equally diffused through the mass of each other; and whether it be the upper or the lower part of the air that is taken out of the vessel, without disturbing the rest, it will contain an equal mixture of them both."

Another suggestive paper is on "Respiration and the Use of the Blood," which was read to the Royal Society on January 25, 1776, and appears in the *Phil. Trans.*, vol. lxvi. Priestley, of course, regarded respiration as a *phlogistic process*, and "that the use of the lungs is to carry off a putrid *effluvium*, or to discharge that phlogiston, which had been taken into the system with the aliment, and has become, as it were, *effete*, the air that is respired serving as a menstruum for that purpose." This he thinks he has "proved to be effected by means of the *blood*, in consequence of its coming so nearly into contact with the air in the lungs, the blood appearing to be a fluid wonderfully formed to imbibe and part with that principle which the chemists call phlogiston, and changing its colour in consequence of being charged with it or being freed from it." The *facts* in this paper are for the most part correctly stated, but the discoverer of oxygen led the world woefully astray as to the part played by that gas in the phenomena of respiration.

The fourth volume made its appearance in March 1779, with a dedication to Sir George Savile, who had rendered Priestley the service of introducing him and his invention of soda-water to the notice of the Admiralty. In the preface, which is commendably short, he makes some reference to the respite which he had promised himself and his readers, but trusts, by way of extenuation, "it may be sufficient to allege the instability of human purposes and pursuits." He had intended to devote himself to metaphysics.

"But that kind of writing," he says, "is a thing of a very different nature from this. I can truly say. . . that single sections in this work have cost me more than whole volumes of the

other ; so great is the difference between writing from the head only and writing, as it may be called, from the hands."

The fact was Priestley could not keep away from his laboratory.

" Having acquired a fondness for experiments, even slighter inducements than I have had would have been sufficient to determine my conduct."

The preface is noteworthy for its plea for the position of experimental science in the scheme of general education.

" If we wish to lay a good foundation for a philosophical taste, and philosophical pursuits, persons should be accustomed to the sight of experiments and processes in early life. They should, more especially, be early initiated in the theory and practice of *investigation*, by which many of the old discoveries may be made to be really *their own*; on which account they will be much more valued by them. And, in a great variety of articles, very young persons may be made so far acquainted with everything necessary to be previously known as to engage (which they will do with peculiar alacrity) in pursuits truly original."

In the course of some observations on the effect " of impregnating oil of vitriol with nitrous acid vapour " he discovered *nitrosulphuric acid*, the so-called " Lead Chamber Crystals," whose properties and behaviour with water he describes with accuracy and even eloquence. Of these crystals he says : " A more beautiful appearance can hardly be imagined, and I am afraid I shall never see the like again." He also noticed the formation of the dark brown compound which nitric oxide forms with a solution of green vitriol, and adds :—

" To determine whether the phenomena attending the impregnation of the solution of green vitriol with nitrous air depended in any measure upon the seeming *astringency* of that solution . . . I impregnated a quantity of *green tea*, which is also

said to be astringent, with nitrous air, but no sensible change of colour was produced in it."

He several times noticed the deep blue liquid which nitrogen peroxide forms with cold water. He made many attempts to use nitric oxide as an antiseptic, especially for culinary purposes. But the gastronomic results with fowls and pigeons were not to his liking, although he says, "my friend Mr Magellan . . . had not so bad an opinion of this piece of cookery as I had." One cannot read Priestley's description of his multifarious experiments without being struck with the number of occasions in which he just missed making discoveries of first-rate importance. It is obvious that he had obtained chlorine without recognising it, even before the news of Scheele's discovery reached this country. He had also prepared, without knowing it, phosphoretted hydrogen and phosphorous acid. At times, however, he can follow a clue with remarkable perspicacity; as in his observation of the cause of the "flouring" of mercury, and in his discovery of a method of removing lead and tin from that metal.

The subject of "dephlogisticated air" naturally continued to interest him, and he again returns to it in this volume, for he says:—

"As it sometimes amuses myself it may perhaps amuse others to look back with me to the several steps in the actual progress of this investigation, some of which I overlooked in my last account of it."

He points out, as already stated, that he must have had the new gas in his hands as far back as November 1771, having obtained it from nitre. He admits that he had no particular view in making his crucial experiment of August 1, 1774,

"excepting that of extracting air from a variety of substances

by means of a burning lens in quicksilver, which was then a new process with me, and which I was very fond of."

He explains how he was led to his speculation that "this kind of air, and consequently of atmospherical air, which is the same thing but in a state of inferior purity," consists "of earth and spirit of nitre."

"But," he adds, "I have since seen reason to suspect that hypothesis, plausible as it appears. Indeed, some of my late experiments would lead me to conclude that there is no acid at all in pure air."

He then experiments with manganese, which Scheele, who independently discovered oxygen, had already employed, and finds that it yields the new air both when heated alone or with oil of vitriol. The production of oxygen from manganese was contrary to his expectations as the substances he had hitherto used, the *precipitate per se* and the *red lead* and the nitre, had all been subjected to "the influence of the atmosphere," whereas "here was pure air from a substance which for anything that appeared had always been in the bowels of the earth, and never had had any communication with the external air." This led to the surmise that possibly the expulsion of dephlogisticated air from such mineral substances

"might assist in sustaining subterraneous fires. . . . The solution of the phenomena of subterraneous fires would certainly be much easier on the supposition of their supplying their own *pabulum*, by means of dephlogisticated air contained in substances exposed to their heat. I therefore desired Mr Landriani, who being in Italy had a good opportunity of making inquiries on the subject, to inform me whether any of those substances, and particularly *manganese* be found in their volcanoes; and his answer makes it rather probable that those fires are, in part, sustained by this means."

The ease with which nitre parts with its oxygen on

heating furnished Priestley with the true explanation of its so-called "detonation," "concerning which," he says, "the most improbable conjectures have been advanced by the most eminent philosophers and chemists." After a reference to the hypothesis of Macquer, who assumes that what he calls "*a nitrous sulphur*" is produced, Priestley points out that

"the doctrine of dephlogisticated air supplies the easiest solution imaginable of this very difficult phenomenon. Let any person but attend to the phenomena of the detonation of charcoal in nitre, and that of dipping a piece of hot charcoal into a jar of dephlogisticated air, and I think it will be impossible for him not to conclude that the appearances are the very same and must have the same cause."

Of all the quantitative exercises performed by Priestley, by far the most numerous depended upon his application of nitric oxide to measure the "goodness" of air.

"When," he says, "I first discovered the property of nitrous air as a test of the wholesomeness of common air, I flattered myself that it might be of considerable practical use, and particularly that the air of distant places and countries might be brought and examined together with great ease and satisfaction; but I own that hitherto I have rather been disappointed in my expectations from it. . . . I gave several of my friends the trouble to send me air from distant places, especially from manufacturing towns, and the worst they could find to be actually breathed by the manufacturers, such as is known to be exceedingly offensive to those who visit them; but when I examined those specimens of air in Wiltshire, the difference between them and the very best air in this county, which is esteemed to be very good, as also the difference between them and specimens of the best air in the counties in which these manufacturing towns are situated, was very trifling. . . . I have frequently taken the open air in the most exposed places in this country at *different times of the year*, and in different states of the *weather*, etc., but never found the difference so great as the

inaccuracy arising from the method of making the trial might easily amount to or exceed."

Other observers, less careful or more sanguine than Priestley, were, however, successful in detecting the differences which prejudice led them to anticipate. Thus Signor Marsilio Landriani of Milan, whose name has already been mentioned in connection with the theory of subterraneous fires, in the course of a tour through Italy had the satisfaction of convincing himself "that the air of all those places, which from the long experience of the inhabitants has been reputed unwholesome, is found to be so to a very great degree of exactness by the *eudiometer*. . . . The air of the Pontine lakes, that of the Sciroccho at Rome (so very unwholesome), that of the Campagna Romana, of the Grotto del Cane, of the Zolfatara at Naples, of the baths of Nero at Baja, of the seacoast of Tuscany, were all examined by me and found to be in such a state as daily experience led me to expect."

Modern eudiometry, making use of methods of far greater precision than were possible to Priestley, has confirmed his supposition that atmospheric air is remarkably constant in composition, and that its wholesomeness depends upon other causes than the relative amount of the dephlogisticated air contained in it.

Perhaps the most important of the many papers contained in this volume are those which relate to the "Melioration of Air by the Growth of Plants," a subject to which Priestley gave attention, even whilst at Leeds, in 1771. In these papers he clearly proves that this "melioration" is connected with the green matter of leaves and that it is dependent upon sunlight. This observation is of fundamental importance and attracted much attention.

In the fifth volume, which was published in the

spring of 1781, with a dedication to Dr Heberden, when Priestley had moved to Birmingham, he again returns to this subject. Practically all the experimental work to which it relates was done whilst he was with Lord Shelburne, and mainly at Calne. During the former parts of the summer of 1780 he suffered from an illness which greatly interfered with his work, although he thinks that during his incapacity for making experiments his "hints for the farther prosecution of them are greatly accumulated." It cannot be said that the five papers on the relations of vegetation to air, with which the volume opens, added very materially to the fundamental fact which Priestley had discovered. They furnished, however, additional evidence of it and no doubt stimulated further inquiry. If his facts could not be controverted, his explanations and surmises were at least open to attack, and a number of observers, both here and abroad, busied themselves with the problems of physiological botany thereby suggested.

As regards the subject of "air" in general, although a large number of isolated observations are recorded in somewhat tedious detail, no new fact of first-rate importance is apparent. The experiments are largely supplementary to those in the preceding volumes and are for the most explanatory or corroborative of them. Perhaps the most important are those dealing with "the production of nitrous air in which a candle will burn," by which is signified the gas we now know as nitrous oxide, but which Priestley eventually termed *dephlogisticated nitrous air*. The process he employed is no longer used in the production of this gas, but it sufficed in his hands to determine its individuality without doubt.

Priestley's methods of experiment with his various "airs" were very uniform. He tried their solubility in water, their power of supporting or extinguishing flame, whether they were respirable, how they behaved with acid and alkaline air, and with nitric oxide and inflammable air, and lastly how they were affected by the electric spark. He occasionally made attempts to weigh them, but his determinations of their relative density were altogether untrustworthy. Indeed, it is evident from the terms in which he speaks of these efforts that he was conscious of their inadequacy. The result of submitting alkaline air (ammonia) to the electric spark, whereby it is resolved into nitrogen and hydrogen, surprised him not a little.

"There are few experiments the *rationale* of which I less pretend to understand than the production of genuine and permanent inflammable air from alkaline air by means of the electric spark. . . . One query on this subject is, whence comes the phlogiston, which is certainly a principal ingredient in the constitution of inflammable air. Alkaline air, indeed, contains phlogiston, because in the manner in which I have generally produced it, it is itself partially inflammable; but it is not nearly so much so as the inflammable air which is produced by means of it. Besides, it will appear by the following experiments that the quantity of the inflammable air far exceeds that of the alkaline."

Although Priestley clearly recognised the production of the inflammable air, "in no respect to be distinguished from that which is extracted from metals by acids," and inferred it must come from the alkaline air ("the production having its limits"), he failed to detect the other constituent of ammonia. His determination of the actual increase in volume was inaccurate, and his attempt to explain the phenomenon wholly fallacious.

At the instigation of Mr Woulfe, whose name mainly lives in connection with a useful piece of chemical apparatus, Priestley was encouraged to hope that he would

"find something remarkable in the solution of *manganese* in spirit of salt. Mr Woulfe, however, in a very friendly manner, at the same time, cautioned me with respect of the vapour that would issue from it, as from his own experience he apprehended it was of a very dangerous nature. . . . I cannot say that it was the apprehension of danger, but rather having other things in view, that prevented my giving much attention to the subject."

Priestley's experiments led to no decisive result: he of course recognised the

"peculiar smell, exactly resembling that which is procured by dissolving *red lead* in the same acids. . . . On the application of heat it was easy to perceive that air, or vapour, was expelled; but it was instantly seized by the quicksilver. . . . This is a new field that is yet before me."

Priestley never occupied that field. It is tolerably certain that both Woulfe and he had unknowingly prepared *chlorine gas*, but the glory of its discovery belongs to Scheele.

The paper "Of Sound in Different Kinds of Air" is worth quoting as showing Priestley at his best:—

"Almost all the experiments that have hitherto been made relating to *sound* have been made in common air, of which it is known to be a vibration, though it is likewise known to be capable of being transmitted by other substances. There could be little doubt, however, of the possibility of sound *originating* in any other kind of air, as well as being *transmitted* by them; but the trial had not been actually made, and I had an easy opportunity of making it.

"Besides, the experiments promised to ascertain whether the *intensity* of sound was affected by any other property of the air in which it was made than the mere *density* of it. For

the different kinds of air in which I was able to make the same sound, besides differing in specific gravity, have likewise other remarkable chemical differences, the influence of which with respect to sound would, at the same time, be submitted to examination.

“Being provided with a piece of clock-work, in which was a bell, and a hammer to strike upon it (which I could cover with a receiver, and which, when it was properly covered up, I could set in motion by the pressure of a brass rod going through a collar of leather), I placed it on some soft paper on a transfer. Then taking a receiver, the top of which was closed with a plate of brass, through which the brass rod and collar of leathers was inserted, I placed the whole on the plate of an air-pump, and exhausted the receiver of all the air that it contained. Then removing this exhausted receiver, containing the piece of clock-work, I filled it with some of those kinds of air that are capable of being confined by water. . . . Then by forcing down the brass rod through the collar of leathers I made the hammer strike the ball, which it would do more than a dozen times after each pressure. And the instrument was contrived to do the same thing many times successively after being once wound up.

“Everything being thus prepared, I had nothing to do, after filling the same receiver with each of the kinds of air in its turn, but receding from the apparatus, while an assistant produced the sound, to observe at what distance I could distinctly hear it. The result of all my observations, as far as I could judge, was that the intensity of sound depends solely upon the *density* of the air in which it is made, and not at all upon any chemical principle in its constitution.

“In inflammable air the sound of the bell was hardly to be distinguished from the same in a pretty good vacuum; and this air is ten times rarer than common air.

“In fixed air the sound was much louder than in common air, so as to be heard about half as far again; and this air is in about the same proportion denser than common air.

“In dephlogisticated air the sound was also sensibly louder than in common air, and, as I thought, rather more than in the proportion of its superior density; but of this I cannot pretend to be quite sure.

"In all these experiments the common standard was the sound of the same bell in the same receiver, every other circumstance also being the same; the air only being changed by removing the receiver from the transfer and blowing through it, etc."

The sixth and last volume appeared in 1786 with a dedication to William Constable, Esq., of Barton Constable.

In the preface Priestley is concerned to defend himself against the charge that he occupies himself too much with Theology to the detriment of Natural Philosophy. Theology, he pleads, is his original and proper province, and for which, therefore, he may be allowed to have a justifiable predilection. But as with Metaphysics, so with Theology, Neither subject engrossed so much of his time as some persons imagined.

"I am particularly complained of at present as having thrown away so much time on the composition of my *History of the Corruptions of Christianity*, and of the *Opinions Concerning Christ*. But I can assure them, and the nature of the thing, if they consider it, may satisfy them, that the time I must necessarily have bestowed upon the experiments, of which an account is contained in this single volume, is much more than I have given to the *six*, of which the above-mentioned works consist, and to all the controversial pieces that I have written in defence of the former of them. The labour and attention necessary to enable me to write single paragraphs in this work have been more than was requisite to compose whole sections or chapters of the former. . . . Besides, these different studies so relieve one another that I believe I do more in each of them, by applying to them alternately, than I should do if I gave my whole attention to one of them only."

But Priestley's main defence rests "on the superior dignity and importance of *theological studies* to any other whatever." The whole preface must be read in the light of Priestley's altered circumstances and of his

relations to the theological world, which, since his removal to Birmingham, had greatly increased in weight and importance. As already stated, he regarded himself as ordained to champion the cause of religion among the persons to whom his writings as a natural philosopher specially appealed. The author of the *Institutes of Natural and Revealed Religion* was the writer of the *Letters to a Philosophical Unbeliever* and, in an age of unbelief, the doughty antagonist of Gibbon. Otherwise the incongruous mixture of Theology and Natural Philosophy, of which the preface is made up, seems inexplicable.

To the historian of chemistry the last volume of the series is hardly less interesting than any one of its predecessors, not so much as affording knowledge of new "airs" as by reason of Priestley's relation to the waning doctrine of phlogiston, and on account of the part that his own work was playing, in spite of himself, in completing its overthrow. The volume indeed significantly opens with "Experiments relating to Phlogiston," a reprint with notes of his paper in the 73rd volume of the *Philosophical Transactions*. Priestley truly says:—

"There are few subjects, perhaps none, that have occasioned more perplexity to chemists than that of *phlogiston*, or, as it is sometimes called, the principle of *inflammability*. It was the great discovery of STAHL that this principle, whatever it be, is transferable from one substance to another, how different soever in their other properties, such as sulphur, wood, and all the metals, and therefore is the same thing in them all. But what has given an air of mystery to this subject has been that it was imagined that this principle, or substance, could not be exhibited except in combination with other substances, and could not be made to assume separately either a fluid or solid form. It was also asserted by some that phlogiston was

so far from adding to the weight of bodies that the addition of it made them really lighter than they were before; on which account they chose to call it *the principle of levity*. This opinion had great patrons.

"Of late it has been the opinion of many celebrated chemists, Mr Lavoisier among others, that the whole doctrine of phlogiston has been founded on mistake, and that in all cases in which it was thought that bodies parted with the principle of phlogiston, they in fact lost nothing, but on the contrary acquired something; and in most cases an addition of some kind of air; that a *metal*, for instance, was not a combination of two things, viz., an *earth* and *phlogiston*, but was probably a simple substance in its metallic state; and that the calx is produced not by the loss of phlogiston, or of anything else, but by the acquisition of air."

He then goes on to say that the arguments in favour of this opinion, especially those which were drawn from the experiments of Lavoisier on mercury, were "so specious" that he owns he was much inclined to adopt it. But he was evidently loth to part company with a conception which had hitherto been the central idea of his chemical creed, the very key-stone of the structure which he was pleased to regard as his philosophy. As an abstract conception, as the principle of levity, as something which was the negation of mass and which gravity repelled, phlogiston was eminently unsatisfactory. But what if phlogiston were an entity? A ponderable substance, no matter how light? In that case Stahl's generalisation might still afford salvation. "My friend, Mr Kirwan"—a clever, ingenious Irishman, with a nimble wit and a facile pen—supplied the hint—"Phlogiston was inflammable air"—and Priestley by a series of experiments, faultless as to execution but utterly fallacious as to interpretation, persuades himself that Kirwan is right and that Mr Lavoisier's opinion

and his "specious arguments" are therefore to be discountenanced. The paper, in certain respects, is one of the most noteworthy of Priestley's productions. The experiments are original, ingenious and striking, but as an example of his inductive capacity, or as an indication of its author's logical power, or of his ability to try judicially the very issue he has raised, it is significant only of the profound truth of his own words that

"we may take a maxim so strongly for granted that the plainest evidence of sense will not entirely change, and often hardly modify, our persuasions; and the more ingenious a man is, the more effectually he is entangled in his errors, his ingenuity only helping him to deceive himself by evading the force of truth."

The next paper in the volume, on "The Seeming Conversion of Water into Air," is a record of experiments which cost Priestley much labour and the Lunar Society, for a time, much mystification. Priestley eventually detected the fallacy in the observation which originally induced him to believe that it was possible to transmute water into a permanently elastic fluid, but he got no further in his explanation than that air has a faculty of passing through the pores of an earthen vessel "by means of a power very different from that of pressure."

This and the third paper in the series are classical, and this partly by reason of, and partly in spite of, their blunders, for they are the record of the work upon which James Watt largely based his conjectures concerning the real chemical nature of water, whereby his name has been associated with that of Cavendish and Lavoisier as the true discoverer of its composition. In the course of his inquiry Priestley studied the action of

steam upon red-hot iron by an arrangement generally similar to that employed by Lavoisier, but his explanation of the phenomena is essentially different from that of the French chemist, as may be seen from the following quotation :—

“ Since iron gains the same addition of weight by melting it in *dephlogisticated air*, and also by the addition of *water* when red-hot, and becomes, as I have already observed, in all respects the same substance, it is evident that this air or water, as existing in the iron, is the very same thing ; and this can hardly be explained but upon the supposition that water consists of two kinds of air, *viz.*, inflammable and dephlogisticated.”

This, however, is how Priestley actually does explain it :—

“ When iron is melted in dephlogisticated air we may suppose that, though part of its phlogiston escapes to enter into the composition of the small quantity of fixed air which is then procured, yet enough remains to form *water* with the addition of the dephlogisticated air which it has imbibed, so that this *calx* of iron consists of the intimate union of the pure *earth of iron* and of *water* ; and therefore when the same *calx*, thus saturated with water, is exposed to heat in inflammable air, this air enters into it, destroys the attraction between the water and the earth, and revives the iron while the water is expelled in its proper form.

“ Consequently, in the process with *steam*, nothing is necessary to be supposed but the entrance of the water and the expulsion of the phlogiston belonging to the iron, no more phlogiston remaining in it than what the water brought along with it, and which is retained as a constituent part of the water or of the new compound.”

No more striking illustration of how a man's ingenuity may help him to deceive himself could be given than is afforded by this passage. Priestley to the end of his days never got a just conception of the real chemical constitution of water.

The remaining papers call for little comment. In the course of some further inquiries Priestley discovered *sulphuretted hydrogen*, termed by him *sulphurated inflammable air*, and which he prepared by the action of oil of vitriol upon ferrous sulphide. This gas must of course have been frequently obtained or perceived by him, and possibly by others, as it is produced by a number of processes. Its characteristic smell was associated with sulphur: it was thought to be nothing but inflammable air modified or polluted by the accidental presence of sulphur. It cannot be held that Priestley drew the same sharp distinctions between the various kinds of inflammable air that we draw to-day. To us they are essentially different substances. Priestley, however, regarded them as in the main phlogiston combined or associated with other substances which affected the character of their flames or gave them different properties. In his opinion they were essentially the same. This fact serves to explain what is otherwise incomprehensible, and accounts for many of his mistakes.

The last paper in the volume, excluding the "Supplementary Observations," has a special interest. It is entitled "Observations relating to Theory," and is in fact Priestley's Confession of Faith in the doctrine which enslaved and misled him throughout the whole of his scientific career. But he makes it so hesitatingly and with so many reservations that one wonders why he is constrained to make it at all. He appears to think, however, that it is expected of him.

"It is always our endeavour, after making experiments, to generalise the conclusions we draw from them, and by this means to form a *theory*, or *system of principles*, to which all the facts may be reduced, and by means of which we may be able

to foretell the results of future experiments. . . . In my former publications I have frequently promised to give such a *general theory* of the experiments in which the different kinds of air are concerned, as the present state of our knowledge of them will enable me to do. But, like Simonides with respect to the question that was proposed to him concerning God, I have deferred it from time to time ; and indeed I am more than ever disposed to defer it still longer, as I own that I am at present even less able to give such a theory as shall satisfy myself than I was some years ago ; new difficulties having arisen, which unhinge former theories, and more experiments being necessary to establish new ones.

“Fluctuating, however, as the present state of this branch of knowledge is, I do not think that I can, on this occasion, entirely decline giving some observations of a theoretical nature, and though I cannot pretend to perform the whole of my promise, I shall give a summary view of what appears to me to be the constituent parts of all the kinds of air with which we are acquainted, and a more particular account of the hypothesis concerning phlogiston, which is at present more an object of discussion than anything else of a theoretical nature.”

Priestley then passes in review all the “airs” of which the chemistry of his time had any knowledge, giving the *elements* or constituent principles of which he imagined them to be composed.

The only kind of air that he thinks to be properly *elementary*, and to consist of a simple substance, is *dephlogisticated air*, with possibly the addition of the principle of heat, which, as it is not probable that it adds to the *weight* of bodies, can hardly be called an *element* in their composition.

“Dephlogisticated air appears to be one of the elements of water, of fixed air, of all the acids, and of many other substances which, till lately, have been thought to be simple. The air of the atmosphere, exclusive of a great variety of foreign impregnations, appears to consist of dephlogisticated and phlogisticated air.”

As regards *phlogisticated air*—the mephitic air of Rutherford, the azote of Lavoisier, the nitrogen of Chaptal—Priestley, reasoning from Cavendish's work, concluded that it was probably not elementary, but "that it consists of nitrous acid and phlogiston; this acid having always been produced by decomposing it with . . . dephlogisticated air."

He is conscious, however, of the insufficiency of this hypothesis, and suggests

"that the *acid principle* is supplied by the dephlogisticated air, while the nitrous air gives the base of the nitrous acid and phlogiston; and then this [phlogisticated] air may perhaps be considered as phlogiston combined not with all the necessary elements of nitrous acid, but only what may be called the base of it, *viz.*, the dephlogisticated nitrous vapour, or something which when united to dephlogisticated air will constitute nitrous acid."

"*Fixed air* (carbonic acid) seems to be a compound of phlogiston and dephlogisticated air." In other words, carbonic acid and water have, according to Priestley, "the same elementary composition." "It is something remarkable that two substances so different from each other as *fixed air* and *water* should be analysed into the same principles. But there is this difference between them, that water is the union not of pure phlogiston but of inflammable air and dephlogisticated air."

Of the true nature of *inflammable air*, Priestley, as we have more than once had occasion to point out, had only the vaguest notions.

"Inflammable air," he says, "seems now to consist of water and inflammable air, which however seems extraordinary, as the two substances are hereby made to involve each other, one of the constituent parts of water being inflammable air, and one of the constituent parts of inflammable air being water; and therefore, if the experiments would favour it (but I do not see that they do so) it would be more natural to suppose that water,

like fixed air, consists of phlogiston and dephlogisticated air in some different mode of combination."

That Priestley to the last imagined that the various kinds of inflammable air known to him were at bottom one and the same substance, modified or affected by other substances, accidental and unessential, might be proved by a number of passages. He says with respect to inflammable air generally :—

"There is an astonishing variety in the different kinds of inflammable air, the cause of which is very imperfectly known. The lightest, and therefore, probably, the purest kind seems to consist of phlogiston and water only. But it is probable that *oil*, and that of different kinds, may be held in solution in several of them, and be the reason of their burning with a lambent flame, and also of their being so readily resolved into fixed air when they are decomposed with dephlogisticated air ; though *why* this should be the case I cannot imagine."

Nitrous air (nitric oxide) he conceives to be a combination of a dephlogisticated nitrous air and phlogiston, and that by adding to it dephlogisticated air and water it is converted into nitrous acid.

Dephlogisticated nitrous air (nitrous oxide) he conceives may, like dephlogisticated air, be an elementary substance and to be formed by depriving nitrous air of its phlogiston.

The various *acid airs* (e.g., marine acid air, vitriolic acid air, etc.) consist of the peculiar acids as vapours combined with phlogiston.

The *Alkaline air* (ammonia) he thought to consist of inflammable air and phlogisticated air (nitrogen),

"or of something capable of being converted into phlogisticated air. . . . That water enters into the composition of alkaline air seems necessary to be admitted, because it is decomposed into inflammable air, which I cannot help thinking necessarily requires water. It seems, however, clearly to be inferred . . . that there is no occasion to admit the *alkaline principle* into the

number of *elements*; the *alkalinity*, as I may say, some way or other, arising from phlogiston, or phlogisticated air, as *acidity* arises from dephlogisticated air."

After these theoretical speculations, "in which," he says, "I fear I have not communicated much light, though it is as much as I have been able to get," Priestley proceeds to make some observations relating to *phlogiston*, "the existence of which is at present a great subject of discussion with philosophers; some maintaining that there is no such thing, and others holding the doctrine of STAHL on the subject."

"According to STAHL, phlogiston is a real substance, capable of being transferred from one body to another; its presence or absence making a remarkable difference in the properties of bodies, whether it add to their *weight* or not. Thus he concluded that oil of vitriol deprived of water, and united to phlogiston, becomes sulphur; and that the calces of metals, by the addition of the same substance, become metals. . . . What is now contended for is that in the oil of vitriol changing into sulphur something is lost and nothing gained, and also that a calx becomes a metal by the loss of air only. And did facts correspond to this theory it would certainly be preferable to that of STAHL, as being more simple; there being one principle less to take into our account in explaining the changes of bodies. But I do not know of any case in which phlogiston has been supposed to enter into a body, but there is room to suppose that something does enter into it. . . .

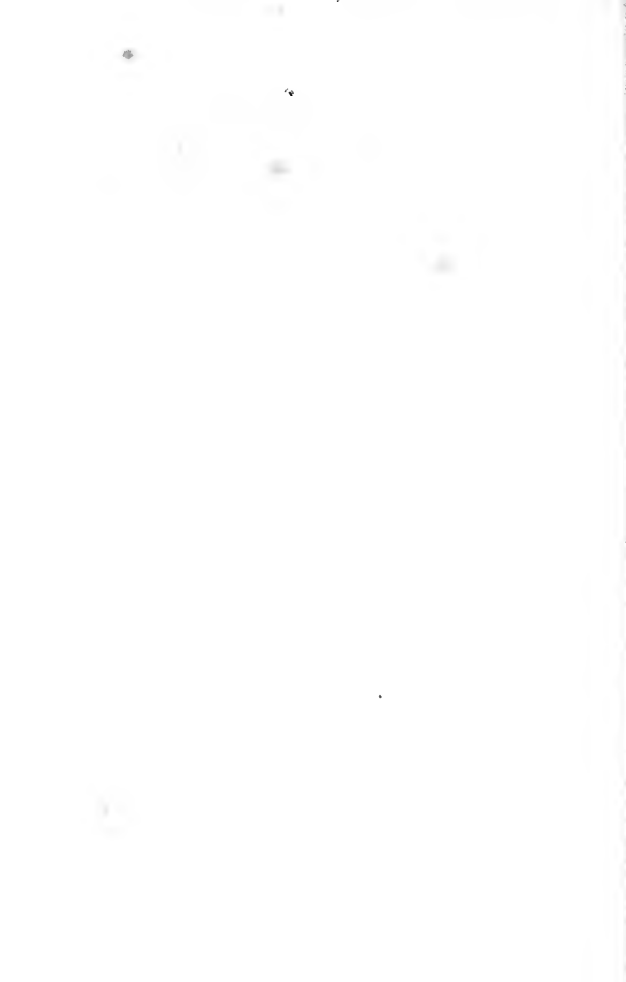
"What has been insisted upon, as most favourable to the exclusion of phlogiston, is the revival of mercury without the addition of any other substance from the precipitate *per se*. In this case it is evident that mere *heat* . . . is sufficient to revive the metal. And as what is expelled from this calx is the purest dephlogisticated air, it has been said that mercury is changed into this calx by imbibing pure air, and therefore becomes a metal again, merely in consequence of parting with that air."

The dexterous Mr Kirwan, not long before he himself embraced the French doctrine, furnished Priestley with

an argument which satisfied him that this cardinal fact can be accounted for without excluding phlogiston. "Since therefore the supposition is exceedingly convenient, if not absolutely necessary, to the explanation of many other facts in chemistry, it is at least advisable not to abandon it."

"That calces do not become metals merely by parting with the air they contain, is evident from my experiments on heating them in contact with inflammable air, in which the inflammable air, or some necessary part of it, is undoubtedly absorbed; and though a little moisture be deposited in the process, it may well be supposed to be that which in conjunction with phlogiston constituted the inflammable air. And what can the other principle that is absorbed by the calx be but the same thing which, when united to water, is recovered again from the metal and found to be inflammable air having all the same properties with that which was employed in the revival of it. Metals therefore are not simple substances, but consist of their calces, and something else which they take from inflammable air. And as the same may also be taken from any combustible substance, it corresponds exactly to STAHL's phlogiston, and therefore the doctrine of it is confirmed by these experiments; that is, we must still say that in all combustible substances there is a principle capable of being transferred to other substances, which when united to the calces of metals makes them to be metals, and which, united to oil of vitriol (deprived of its water) makes it to be sulphur."

Thus was the ingenious man effectually entangled in his errors, his ingenuity helping him to deceive himself by evading the force of truth. To err is human. If Priestley saw through a glass darkly, and but dimly discerned the truth, he at least strove, so far as in him lay, to reach the light. Posterity forgives, and may well forget, his errors in grateful recognition of the many noble services he rendered to our common humanity, and in humbling recollection of the suffering and sacrifice with which those services were requited.



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